Utah Department of Transportation

2002 Standard Specifications

FOR ROAD AND BRIDGE CONSTRUCTION

U.S. Standard Units (Inch-Pound Units)

Change Five

July 14, 2003

Memorandum UTAH DEPARTMENT OF TRANSPORTATION

DATE: July 16, 2003

TO: Holders of Hard Copy of Standard Specifications

FROM: Barry Axelrod, CDT
Standards and Specifications

SUBJECT: Standard Specifications Distribution, Change 5, dated July 14, 2003 (Corrected)

A new Index and updated Standard Specifications are attached. Please take the following action with respect to the attached pages. When done post this page in front of your book. This memo page is a corrected copy.

REMOVE	**INSERT**
Index Of Standard Specifications	Index Of Standard Specifications
Listing of Revised Standard Specifications	Listing of Revised Standard Specifications
00727 (dtd August 29, 2002)	00727 (dtd June 26, 2003) (Revised)
01452 (dtd July 3, 2002)	01452 (dtd June 26, 2003) (Revised)
01721 (dtd February 27, 2003)	01721 (dtd June 26, 2003) (Revised)
02741 (dtd April 24, 2003)	02741 (dtd June 26, 2003) (Revised)
02752 (dtd April 24, 2003)	02752 (dtd June 26, 2003) (Revised)
02786 (dtd July 3, 2002)	02786 (dtd June 26, 2003) (Revised)
02962 (dtd July 3, 2002)	02962 (dtd June 26, 2003) (Replaced)

If you are in need of electronic copies of any of the Standard Specifications please refer to the Standards and Specifications Web page on the. The web address is http://www.dot.utah.gov/esd/esdmenu3.htm. From there select the **2002 Standards** link.

A copy of the Standard Specifications in Adobe pdf format can be found at http://www.udot.utah.gov/esd/2002Standards/Specs/PDFFiles/UDOT2002Specs.pdf. This file will remain static for the remainder of 2003. Changes to the Standards will be posted separately.

If you have any questions or problems with the electronic files contact me at (801) 964-4570 or by email at **baxelrod@utah.gov**.

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Listing of Revised Standard Specifications

Change One

Revised August 29, 2002

Section 00570 Articles 1.2 A 69, A 71 b (deleted)
Section 00727 Articles 1.1 D; 1.5 B; 1.9; 1.10; 1.16 B, C; 1.18 B
Section 01574 Articles 1.2 B
Section 02721 Articles 1.2 D (added), H (replaced), I (deleted); 1.6 B1; 2.1 A Table 3; 3.2 C
Section 02741 Articles 3.8 E 2 a, b
Section 2821 Articles 3.1 A
Section 02892 Articles 1.5 A, B
Section 02936 Articles 1.4; 1.5 C
Section 03152 Articles 1.2 P, Q; 2.2 A, B
Section 05120 Articles 1.4 A (deleted), 3.3 A
Section 16525 Articles 1.6 A, B

Change Two

Revised December 19, 2002

Section 01561 Article 3.1 A
Section 02075 Article 2.7 A
Section 02372 Article 2.1 A 4
Section 02455 Article 3.3 B 2
Section 02785 Article 3.2 C
Section 02861 Article 3.3 A
Section 03055 Articles 1.2 P (inserted), 2.3 B, 2.4 (deleted), 2.7 A 1 a-e (added), 2.7 B 2 (added), 2.8 A 1 a, 2.8 A 2 (deleted), 2.9 A3, 3.2 A Table, 3.2 C, 3.7 A 3, 3.8 C 1, 3.9 A-B, 3.10, 3.11 B 1, 3.11 B 3
Section 07922 Article 2.1 Table 1

Change Three

Revised February 27, 2003

Section 01355 Article 1.3 A 3
Section 01721 1.4 C deleted and moved to Measurement and Payment document
Section 02222 Changed title from Site Demolition-Pavement to Site Demolition - Concrete, A, 3.2 Title, 3.2 A
Section 02224 New Specification
Section 02316 1.2 A, D, I added, 1.3 added, 1.7 B, C, D, E, F, G added, 3.9 A added
Section 02455 3.3 B 2 (corrected error from change two)
Section 02721 1.2 Related Sections added, 1.3 H and I added, 1.7 B, 1.7 F deleted, 2.1 B added, 2.2 deleted, 3.1 Title changed, 3.2 B reference added, 3.2 E added
Section 02741 1.4 C6a added, 1.4 H, Table 3, 2.4 A, 2.4 C, Table 9, 2.5 B 1-3, 2.5 B 4 added, 2.5 D, 3.1 Al deleted, 3.2 C3 added, 3.7 D1, 3.9 B4, 3.9 B5 added, 3.9 E note added
Section 02744 Entire Section deleted
Section 02745 1.4 A9
Section 02785 1.2 C and D added
Section 02892 Added Articles, 1.3 N, O, Y, 1.5 D, 2.4 I, 2.5 C, D, E, 2.6 B3 - B6, 2.6 C, 2.16, 2.17, 3.11 and Revised Articles 3.5 F and Table Number, 3.5 G and Table Number
Section 02896 2.1 A, B and 3.1 A drawing number corrected
Section 16525 1.2 H

Change Four

Revised April 24, 2003

Section 00555 1.18 added Table 1
Section 01280 1.2 K
Section 01282 1.13 B added, 1.13 G 2 deleted
Section 02222 1.2 B Title Changed
Section 02231 3.5 A
Section 02705 Title Changed, 1.1 A, 1.3 added, 3.1 Title changed, 3.1 A, 3.1 D moved, 3.2 added
Section 02741 3.7 B
Section 02747 Entire Section deleted
Section 02752 1.8 E 1
Section 02753 3.1 D 5 a, 3.3 D
Section 02842 2.4A
Section 02861 2.1 I
Section 02911 3.2 A 1
Section 02931 3.2 B
Section 03392 2.1 A 8-9
Section 03921 2.1 A 1, 2.1 C

Section 03922 2.1 B 1-2
Section 03923 2.1 A-B, 3.1 B
Section 03924 2.2 A-B
Section 03935 2.1 A, 2.1 A 2
Section 07105 2.3 A
Section 13553 1.2 C Title Changed
Section 13554 1.1 A, 1.3 C and D added, 2.1 A, 2.1 F, 2.2 D 1, 2.2 D 2 deleted, 2.2 E, 2.2 H, 2.2 H 2, 2.2 H 3 deleted and renumbered, 3.1 B 3 added, 3.1 I

Change Five

Revised June 26, 2003

Section 00727 1.5 B – Measurement and Payment added
Section 01452 Parts 1 and 3 replaced
Section 01721 3.3 A, 3.15 added
Section 02741 1.2 A
Section 02752 1.2 B, 1.9 added, 3.13 deleted
Section 02786 1.2 B, 1.4 D 1
Section 02962 Entire Section Replaced

SECTION 00727

CONTROL OF WORK

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 00555: Prosecution and Progress

B. Section 00725: Scope of Work

C. Section 01282: Payment

D. Section 01721: Survey

1.2 AUTHORITY AND DUTIES OF THE ENGINEER

A. The Engineer decides all questions regarding the quality and acceptability of materials furnished, work performed, rate of work progress, interpretation of the Contract Documents, and the acceptable fulfillment of the Contract.

B. The Engineer has the authority by written order to suspend the work without liability to the Department wholly or in part if the Contractor fails to:
   1. Correct conditions unsafe for the project personnel or the public, or
   2. Complete contract provisions, or
   3. Comply with the Engineer's orders.

C. The Engineer can suspend work wholly or partially for:
   1. Periods of unsuitable weather, or
   2. Conditions unsuitable for the prosecution of the work, or
   3. Any other condition or reason determined to be in the Department's interest.

1.3 PLANS AND WORKING DRAWINGS

A. Keep one full set of plans (provided by the Department) on the project site at all times.

B. Furnish to the Department structure plans with working drawings that detail required work not included in the Contract Plans.

C. Include the cost of furnishing all working drawings in the related Contract Bid Items.

1.4 CONFORMITY WITH PLANS AND SPECIFICATIONS

A. Perform work and furnish materials to meet Contract requirements.

B. If the Contract provides for acceptance of a Contract item not complying fully with the minimum requirements, the Department uses the specified pay adjustment factors for payment.

C. When a Contract item fails to meet Contract requirements but is adequate to serve the design purpose, the Engineer decides the extent to which the work will be accepted and remain in place. The Engineer documents the basis of acceptance by change order and adjusts the Contract Unit Price.

D. Remove, replace, or correct work at no cost to the Department when a Contract item does not meet specified requirements and results in work inadequate to serve the design purpose.

1.5 COORDINATING PLANS, STANDARD SPECIFICATIONS, AND SPECIAL PROVISIONS

A. All supplementary documents are essential parts of the Contract and a requirement occurring in one is binding as though occurring in all. Supplementary documents are complementary and provide and describe the complete Contract.

B. If there is a discrepancy, the governing ranking is:

Dimensions	**Information**
1. Plan	1. Special Provisions
2. Calculated	2. Plans
3. Scaled	3. Measurement and Payment
	4. Standard Specifications
	5. Standard Plans

C. Do not take advantage of any apparent error or omission in the Contract.

D. Notify the Engineer promptly of any omissions or errors in the Contract so that necessary corrections and interpretations can be made.

1.6 CONTRACTOR COOPERATION

A. Facilitate progress of the work, and cooperate with Department inspectors and other contractors.

B. Employ a competent superintendent experienced with the work being performed, and capable of reading and understanding the Contract Documents.

C. The superintendent must be:
   1. Present at the project site at all times.
   2. Available to execute instructions and directions from the Engineer or authorized representatives.
   3. Authorized to act as agent for the Contractor on the work.

D. Supply all necessary resources to complete the Contract, regardless of the amount of work sublet.

1.7 COOPERATION WITH UTILITIES

A. Relocate or adjust utilities when specified.
   1. Use work procedures that consider the potential of inaccurate or inexact utility locations provided by utility owners, especially for underground installations.
   2. Cooperate with the utility owners to remove and rearrange underground or overhead utilities to avoid service interruption or duplicate work by the utility owner.

B. Cooperate with the utility owners to adjust utility fixtures and appurtenances shown in the Contract plans.

C. Use work procedures that protect utilities or appurtenances that remain in place during construction.

D. The Department notifies utility companies, pipeline owners, or other utility agencies affected by the work to verify that all utility adjustments, within or adjacent to the construction limits, are made as soon as possible. Coordinate with utility companies.

E. Notify the appropriate utility authorities of any service interruption resulting from breakage within the construction limits.
   1. Cooperate with authorities until service is restored.
   2. Work around fire hydrants only after obtaining approval by the local fire authority and then only after making provisions for continued service.

F. Repair damage to utilities that results from carelessness or omission. Restore damaged facilities to the preexisting condition at no additional cost to the Department.

G. When directed by Engineer, adjust or relocate utility facilities or appurtenances found but not noted in Contract Documents.
   1. Engineer coordinates with the utility owner.
   2. Department uses Section 00555 or Section 00725 for compensable or non-compensable adjustments to the Contract because of revised or added work.

1.8 COOPERATION BETWEEN CONTRACTORS

A. The Department reserves the right to contract for and perform other or additional work on or near the work covered by the Contract.

B. Cooperate with other contractors working within the project limits. Conduct work without interrupting or inhibiting the progress or completion of work by other contractors.

C. Each contractor involved accepts all liability, financial or otherwise, in connection with the Contract.

D. Each contractor protects and saves harmless the Department from any damages or claims caused by inconvenience, delay, or loss from the presence and work of other contractors working within the same project limits.

E. Coordinate and sequence the work with other contractors. Arrange, place, and dispose of materials without interfering with the operations of other contractors on the same project.

1.9 DEPARTMENT-PROVIDED ROADWAY ALIGNMENT CONTROL POINTS AND ELEVATION BENCH MARKS

A. The Department provides roadway alignment control points and elevation benchmarks.

B. Department deducts the cost of replacing disturbed roadway alignment control points and elevation benchmarks from contract payment. Refer to Section 01721, Article “Payment Procedures” for survey crew costs.

1.10 CONSTRUCTION SURVEY

A. Perform the Construction Surveying necessary to properly control the entire work per Section 01721 “Survey”.

B. Verify all roadway alignment control points prior to beginning the work.

C. Verify all elevation benchmarks prior to beginning the work.

1.11 DUTIES OF INSPECTOR

A. Department Inspectors are authorized to inspect all work and materials furnished.
   1. Inspection may extend to the preparation, fabrication, or manufacture of the materials to be used.
   2. The Inspector is not authorized to alter or waive the contract provisions, to issue instructions contrary to the Contract, or to act as foreman for the Contractor.
   3. The Inspector is authorized to reject work or materials until any issue in question can be referred to and decided by the Engineer.

1.12 INSPECTION OF WORK

A. Provide information, assistance, and safe access to the Engineer for all parts of the work to obtain a complete and detailed inspection.

B. Remove and replace work performed or materials used without supervision or inspection by an authorized Department representative at Contractor expense, if ordered. **Exception:** If the Department representative fails to inspect the work after receiving written notice 24 hours in advance of beginning work.

C. Remove and uncover portions of finished work, as directed. Once inspected, restore work to Contract requirements.
   1. If the uncovered work is found acceptable, the Department pays for the additional cost to uncover, remove, and replace or make good the parts removed as extra work.
   2. If the work is found unacceptable, the Department does not pay for additional costs to uncover, remove, and replace the covering, or make good the parts removed.

D. When a government agency, utility or railroad company is to accept or pay a portion of the Contract cost, that organization's representatives may inspect the work. The right to inspect does not make that entity a party to the Contract and does not interfere with the rights of parties to the Contract.

1.13 REMOVAL OF UNACCEPTABLE AND UNAUTHORIZED WORK

A. Remove and replace any unacceptable work before final acceptance.
   1. Work is considered unacceptable if it fails to meet the Contract requirements, unless accepted under this Section, article, "Conformity with Plans and Specifications."

B. Work performed contrary to Engineer's instructions, work beyond plan limits, or extra work performed without the Engineer's permission:
   1. Is excluded from pay consideration.
   2. May be ordered removed, restored, or replaced by others at the Contractor's expense.

1.14 LOAD RESTRICTIONS

A. Observe legal load restrictions when hauling equipment or materials on public roads beyond project limits.
   1. A special permit does not decrease Contractor liability for damage.
   2. Refer to the "Utah Regulations for Legal & Permitted Vehicles."

B. Do not apply weight restrictions to equipment or materials hauled over subgrade.

C. Do not exceed legal gross weight limits on any public roads, structures, or on any component of the pavement structure excluding granular borrow.

D. Suspend construction operations when load restriction violations are observed until acceptable corrective measures are approved by the Engineer.

E. When public roads are used to haul any type of excavation, borrow, backfill, base, or surfacing material, the Engineer contacts the appropriate law enforcement agency, if excess load violations are suspected.

F. For materials imported to the job site (i.e. Asphalt, Cement, Concrete, Steel, etc.):
   1. Provide the Engineer with invoices showing the gross load weights.
   2. Department withholds payment for material used in the project if invoices are not provided.
   3. The Engineer notifies the appropriate enforcement agency if it is suspected that legal gross load limits are exceeded.

1.15 MAINTAINING THE WORK DURING CONSTRUCTION

A. Maintain the work during construction in a satisfactory condition until the project is accepted.

1. Maintain traffic detour routes and project travel ways in accordance with the accepted traffic control plan.

B. The Engineer immediately notifies the Contractor of failure to meet these provisions.
   1. The Engineer maintains the project if unsatisfactory maintenance is not remedied within 24 hours after receiving notice.
   2. The Department deducts the entire cost for the Engineer to maintain the work from the monies due or to become due the Contractor.

C. Include in the bid unit prices the cost of maintaining work during construction until final acceptance.

1.16 OPENING SECTIONS OF PROJECT TO TRAFFIC

A. The Engineer may order certain sections of work opened to traffic before completion or acceptance of the work.

B. Opening sections of work does not constitute acceptance of the work or a waiver of any contract provisions.

C. Maintain any section of roadway opened to traffic by order of the Engineer.
   1. When the ordered opening to traffic is not the result of Contractor fault or inactivity, Contractor is paid as provided in Section 01282.
   2. The Department prepares a change order when the opening is not provided for in the Contract. Department does not compensate the Contractor if the order to open is the result of Contractor fault or inactivity.

D. Engineer gives written notice establishing a time period for completing features of the work for which the Contractor is late.
   1. Engineer may order all or a portion of the project opened to traffic if the Contractor fails to complete or make a reasonable effort to complete the late work.
   2. Assume liability and responsibility for maintaining the work and conduct the remaining construction operation with minimum interference to traffic without additional compensation.

E. Repair damage to the project that is not attributable to traffic (except landslides) at no additional cost to Department.

1.17 FURNISHING RIGHT-OF-WAY

A. The Department secures all necessary rights-of-way in advance of construction, except as provided in the Contract.

1.18 PROJECT ACCEPTANCE - PARTIAL

A. May request final inspection of a unit when:
   1. A unit or portion of the project is substantially complete, and
   2. The unit or portion is considered or determined necessary for the convenience of traffic, such as a structure, an interchange, section of road, intersection, substation, or portion of highway lighting or traffic signal systems.

B. If the unit has been completed according to the Contract, the Engineer may make written acceptance of that unit as complete and relieve the Contractor of further responsibility for that unit.

1.19 PROJECT ACCEPTANCE - FINAL

A. The Engineer conducts an inspection upon receiving notice from the Contractor of project completion. If the Contract is found to be satisfactorily completed, the inspection constitutes the final inspection and the Engineer notifies the Contractor in writing the date the Contract was inspected and accepted.
B. Immediately comply with and execute instructions given by the Engineer if the inspection discloses any unsatisfactory work.
C. Upon correction of the work, the Engineer conducts another inspection that constitutes the final inspection.
D. If the work has been satisfactorily completed, the Engineer notifies the Contractor in writing of the date of final inspection and acceptance.

1.20 PROCEDURES FOR RESOLUTION OF DISPUTES

A. Notify Department verbally and in writing of the dispute under Section 00725, article, “Notification of Differing Site Conditions, Changes and Extra Work," before beginning or continuing the affected work, if additional compensation is considered due for work or material not covered in the Contract.

B. The Engineer responds as described under Section 00725, article, “Notification of Differing Site Conditions, Changes and Extra Work," following notification, indicates whether or not a change has occurred, and provides further information concerning the method and manner of further performance of the work.

C. Provide cooperation and information to the Engineer during the period of notification review and evaluation.

D. Department does not grant additional compensation if verbal and or written notification is not given, or if the Engineer is not given proper facilities for keeping strict account of actual costs.
   1. Department does not construe notice by the Contractor, and the Engineer's accounting of costs as substantiating the validity of the claim.
   2. Department equitably adjusts the Contract if the dispute is found to have merit.

1.21 PROCEDURES FOR RESOLUTION OF CLAIMS

A. Disputes that are not resolved are escalated to the claims procedure.
   1. Provide written notification of the intent to make a claim under Section 00725, article, "Notification of Differing Site Conditions, Changes and Extra Work."
   2. Submit the formal claim in writing and with sufficient detail to enable the Engineer to ascertain the basis and amount of the claim.

B. As a minimum, include the following information with each claim submitted:
   1. A detailed factual statement of the claim for additional compensation and time, providing all necessary dates, locations, and items of work affected by the claim.
   2. The date actions resulting in the claim occurred or conditions resulting in the claim became evident.
   3. The name, title, and activity of each Department employee knowledgeable about facts that gave rise to the claim.
   4. The name, title, and activity of each Contractor employee knowledgeable about facts that gave rise to the claim.
   5. The specific provisions of the Contract that support the claim and a statement of the reasons why such provisions support the claim.
   6. All detailed facts that support positions related to a decision that the Contract leaves to the Engineer's discretion or provides that the Engineer's decision is final.
   7. Identity of pertinent documents, and the substance of any material verbal communications relating to the claim.
   8. A statement whether the additional compensation or extension of time is based on alleged breach of Contract.
   9. Copies of any identified documents, other than Department documents and documents previously furnished to the Department that support the claim (manuals that are standard to the industry may be included by reference).
   10. For an extension of time include:
      a. The specific days for which a time extension is requested.
      b. The specific reasons a time extension should be granted.
      c. The specific provisions under which a time extension is requested.

11. The exact amount of compensation requested and a breakdown of the cost into the following categories:
    a. Direct labor.
    b. Direct materials.
    c. Direct equipment. Do not exceed actual cost on rates claimed for each piece of equipment. In the absence of actual equipment cost, the rates for the equipment, when in use, cannot exceed the rates established by Section 01282, article, "Differing Site Conditions, Changes, Extra Work," and articles, "Force Account Work - (General, Labor, Materials, Contractor-Owned Equipment, Rented or Leased Equipment, Subcontracts, and Compensation)." Break down the equipment cost in accordance with Section 01282, article, "Force Account work - Contractor-Owned Equipment," and article, "Force Account Work - Rented or Leased Equipment."
    d. Job overhead.
    e. Overhead (general and administrative).
    f. Subcontractor's claims (in the same level of detail as specified in Contract documents is required for any subcontractor's claims).
12. Certification: Submit a statement to the Engineer containing the following language:

Under the penalty of law for perjury or falsification, the undersigned,

_____	_____	_____
Name	Title	Company

hereby certifies that the claim for extra compensation and time, if any, made herein for work on this Contract is a true statement of the actual costs incurred and time sought, and is fully documented and supported under the Contract between the parties.

Dated _____/s/_____
Subscribed and sworn before me this _____day of _____
Notary Public _____
My Commission Expires _____

C. Failure to submit information and details as described in this Section for any claim constitutes a waiver of the claims.

1.22 RECORD KEEPING FOR RESOLUTION OF CLAIMS

A. Maintain full and complete records of all costs and additional time incurred for any alleged claim.

B. Permit the Engineer access to those records and any other records as required to determine the facts or contentions involved in the claim.

C. Retain all records for a period of not less than three years after final acceptance.

1.23 AUDITING OF CLAIMS

A. All claims filed against the Department are subject to audit at any time following the filing of the claim.

B. Employees of the Department or an auditor under contract with the Department may conduct the audit. The audit may begin at any time during the life of the Contract, or 20 calendar days after notice is provided to the Contractor, the subcontractors, or the Contractor's agents if more than 60 calendar days after the final acceptance date of the Contract have elapsed.

C. Provide adequate facilities acceptable to the Engineer for the audit during normal business hours. Cooperate with the auditors.

D. Failure of the Contractor, subcontractors, or agents to maintain and retain sufficient records to allow the auditors to verify all or a portion of the claim or to permit the auditor access to the books and records of the Contractor, subcontractors, or agents constitutes a waiver of the claim and bars any recovery.

E. As a minimum, make the following documents available to auditors:
1. Daily time sheets and supervisor's daily reports.
2. Union agreements.
3. Insurance, welfare, and benefits records.
4. Payroll registers.
5. Earnings records.
6 Payroll tax forms.
7. Material invoices and requisitions.
8. Material cost distribution work sheet.
9. Equipment records (list of company equipment, rates, etc.).
10. Vendors', rental agencies', subcontractors', and agents' invoices.
11. Subcontractors' and agents' payment certificates.
12. Canceled checks (payroll and vendors).
13. Job cost report.
14. Job payroll ledger.
15. General ledger.
16. Cash disbursements journal.
17. All documents that relate to each and every claim together with all documents that support the amount of damages as to each claim.
18. Work sheets used to prepare the claim establishing the cost components for items of the claim including but not limited to labor, benefits and

insurance, materials, equipment, subcontractors, all documents that establish the time periods, individuals involved, the hours for the individuals, and the rates for the individuals.

F. Full compliance with the provisions of this article is a contractual condition precedent to the right to seek judicial relief.

1.24 HIGHER LEVEL REVIEW FOR RESOLUTION OF CLAIMS

A. Submit all claims for higher level review to the Engineer in writing within 10 calendar days of the Engineer's denial of a claim.

B. Failure to submit a request within this 10-day time frame is considered acceptance of the Engineer's denial action.

1.25 CLAIMS BOARD OF REVIEW

A. Pursue administrative resolution of any claim with the Engineer or the designee of the Engineer.

B. If no agreement is reached, at the Contractor's written request to the Engineer, the Engineer for Construction and Materials schedules a hearing before a Department "Claims Board of Review" when deemed to be in the best interest of both the Contractor and the Department.

C. The Board makes recommendations and outlines their reasoning to the UDOT Deputy Director within 30 calendar days after the claim hearing.

D. The UDOT Deputy Director makes offer of settlement within 45 calendar days after the claim hearing.

E. The decision of the UDOT Deputy Director is administratively final.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION Not used.

END OF SECTION

Change One
Revised August 29, 2002

Articles Revised
1.1 D (Added)
1.5 B
1.9
1.10
1.16 B, C
1.18 B

Change Two - December 19, 2002
No changes made

Change Three - February 27, 2003
No changes made

Change Four - April 24, 2003
No changes made

Change Five – June 26, 2003
Revised Article

1.5 B – Measurement and Payment added

SECTION 01452

PROFILOGRAPH AND PAVEMENT SMOOTHNESS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for smoothness testing of (HMA) Hot Mix Asphalt, Open Graded Surface Course (OGSC) and Portland Cement Concrete Pavement (PCCP).

B. Requirements for 25-foot wheel base, California type profilograph with electronic data recording, storing, data reduction, and printing capabilities.

1.2 RELATED SECTIONS

A. Section 02741: Hot Mix Asphalt (HMA)

B. Section 02748: Prime Coat/Tack Coat

C. Section 02752: Portland Cement Concrete Pavement

D. Section 02786: Open-graded Surface Course (OGSC)

1.3 GENERAL REQUIREMENTS

A. Certify profilograph operators and equipment through the Department. Engineer verifies certifications.

B. Comply with project Traffic Control Plan and all applicable safety requirements when performing profilograph testing.

C. Contractor Quality Control
   1. Comply with requirements identified in Section 02741, Part 3, Article 3.8, Contractor Quality Control and Section 02752, Part 3, Article 3.9 Field Quality Control.

2. Address the following minimum items in the QCP:
    a. Identify person(s) responsible for managing smoothness issues and monitoring compliance with requirements.
    b. Identify equipment used to measure and monitor smoothness along with calibration and correlation information.
    c. Identify personnel responsible for operation of equipment and their qualifications.
    d. Identify construction methods employed to obtain smoothness, including:
        - Method of grade control for rotomilling and paving operations.
        - Actions taken to prevent paver from stopping and starting, including any use of additional equipment.
        - Placement of manholes outside of projected wheel paths and methods of matching surface elevations and slopes
    e. Identify potential problems that could interfere with meeting pavement surface requirements.
    f. Describe grinding process and operation:
        - Equipment and operators
        - Must-grind layout, grade control, sealing process, etc.
        - Schedule

1.4 ACCEPTANCE

A. Notify the Engineer in writing a minimum of two working days prior to scheduling Department inspection of acceptance testing on the final pavement surface, after all corrective work has been performed.
    1. Clearly define the areas to be tested for acceptance in the written notification.
    2. Do not perform any work on the final surface after acceptance testing, except as directed by the Engineer.

B. The Department evaluates the surface by section, defined as:
    1. Traffic lane, 0.1 mile in length, including adjacent shoulder with a design width 8.0 ft or less, meeting the Class I description. (See Table 01452-1)
        a. Testing consists of a single trace measurement of each wheel path, defined as a continuous parallel line 2.5 ft inside the projected lane lines, of the traffic lane.
        b. Testing of adjacent shoulder consists of a single trace measurement approximately centered in the shoulder when the design width is 6.0 ft or greater. Do not test shoulders having design widths less than 6.0 ft.
        c. Determine the Profile Index (PI) by taking the average of all profile traces taken on the section.

2. Shoulder, 0.1 mile in length, with a design width greater than 8.0 ft, meeting the Class I description.
    a. Testing consists of two profile traces, 2.0 ft inside each edge, approximately centered in the shoulder.
    b. Determine the Profile Index (PI) by taking the average of profile traces taken on the section.

C. Begin the initial section(s) at the start of the project. Lay out subsequent sections consecutively to the end of the project.

D. The Department does not measure the PI for Class II surfaces.

E. The Department evaluates longitudinal and transverse deviations for both Class I and Class II surfaces.

F. If the final lift of pavement cannot be completed due to seasonal limitations, the Department evaluates all roadway sections paved through the final lift and evaluates the remaining final lift of pavement upon completion.

1.5 MEASUREMENT AND PAYMENT PROCEDURE

A. All work necessary to prepare the pavement for testing, such as but not limited to sweeping, is incidental to the work and is not measured for payment. Include all costs and resources for smoothness testing, preparation and correction in the surfacing bid items.

PART 2 PRODUCTS

2.1 FRAME

A. Construction:
1. All welded of light-weight square aluminum tubing in three separate units of the same dimensions in width and within 6 inches in length of each other.
2. Design: reinforced truss.

B. Length:
1. Effective wheel base of the frame assembly: 25 ft.
2. Overall length with multiple wheel assemblies attached: not to exceed 35 ft.

C. Frame Connections:
1. Indexed with steel location pins or dowels to prevent misalignment of frame assembly.

2. Secured with quick acting clamps rated at a minimum of 800 lbs each.

D. Parts: Each of the three frame units manufactured to allow interchangeable replacement of individual units.

2.2 WHEEL SUPPORT ASSEMBLIES

A. Tubing: All welded, light-weight square aluminum.

B. Connections: All connection points between wheel assemblies and frame sections secured with quick-acting clamps.

C. Support wheels: Cast aluminum hubs with ball bearing supported steel axles and cushion rubber tires. Caster wheel assemblies: Ball bearing supported.

D. Front Wheels: Steerable from the center of the machine.

E. Rear Wheels: Quick setting manual adjustment to allow for short radius turning, moving laterally, and for trimming to avoid crabbing on superelevations.

2.3 RECORDING WHEEL

A. Light weight, 24 inch to 26 inch nominal diameter, and heavy duty spokes.
1. Tire: pneumatic tube type with non-aggressive tread design.
2. Frame: all welded of light-weight square aluminum tubing. Frame pivot points and rotating shafts supported by sealed ball bearings.

2.4 GENERAL MECHANICAL

A. All exposed steel components anodized, nickel plated, or zinc plated for corrosion protection.

B. Interchangeable parts.

C. Capable of being broken down in segments that can fit into the back of a standard pickup truck or van for ease of transport.

D. Constructed to allow complete assembly in less than 15 minutes without tools.

2.5 AC POWER GENERATING UNIT

A. Self-contained, capable of delivering 120 VAC at 60Hz.

B. Mount on the frame with appropriate vibration and shock control hardware.

2.6 MICROCOMPUTER

A. Control the system by a dedicated on-board microcomputer.

B. The microcomputer components replaceable and interchangeable with like items from the manufacturer's stock to facilitate controller repairs and provide the following minimum operation characteristics:
   1. Processor:
      a. Minimal 16 bit microprocessor capable of running at a nominal 8 MHz processing speed.
      b. On-board memory sufficient to store Profile Index (PI) and bump Discrimination software.
      c. RAM memory sufficient to input control parameters and process project documentation variables at the test site.

   2. Displacement Transducer Interface:
      a. Contains an analog to digital converter compatible with the operating characteristics of the microprocessor.
      b. Include signal conditioning for analog filtering and scaling.
      c. Overall resolution for displacement transducer less than or equal to 0.004 inches.

   3. Odometer Transducer Interface: Provides digital logic to encode positive or negative signals to microprocessor.

   4. Clock:
      a. Provides time and calendar functions to microprocessor unit automatically.
      b. Independent battery power required to avoid documentation errors and input data losses caused by on-board power shut downs.

2.7 TRANSDUCERS

A. Rated to withstand shock, vibration, dust, and extremes of humidity. Operational from -30 degrees C to 100 degrees C.
   1. Vertical Displacement Transducer: Resolution of 0.01 inches.
   2. Odometer: horizontal resolution of 0.39 inches and operational in either an incrementing or decrementing mode.
   3. Temperature transducer: Accurate to " 1 degree C.

2.8 PRINTER/PLOTTER

A. Compatible with and provide suitable interfaces with the microprocessor.

B. The data acceptance (baud rate) and buffer storage capacity: adequate to fully register, plot, and accept data from a 4 mph operational run without excessive wait states.

C. Dot matrix mechanism (if applicable): print bar resolution of 100 dots per inch with a row resolution of 200 rows per inch.

2.9 OPERATOR CONTROL PANEL

A. Located within easy access of the operator and in a location on the profilograph that does not hinder other operational functions or line of sight to testing path.

B. Control panel with a digital display, data input key board, observable indicators, (video or screen) and operator actuated control switches.

C. Parameters entered, displayed, and printed as follows (all numeric):
1. Time
2. Date
3. Region, route and pavement
4. Pass number
5. Beginning Station
6. Ending Station
7. Odometer
8. Blanking band width
9. Bump height
10. Bump width
11. Event marker

2.10 REPORTING REQUIREMENTS

A. Determine Profile Index, documentation, reports, outputs, or example, as specified. UDOT Materials Manual, 8-995.

B. Set preprogrammed or operator entered scaling or sensitivity factors at a sensitivity level that to correlate with Department profilographs.

C. Include the following documentation supplied with the Profilograph system:
1. Operator's Manual.
2. Wiring Diagrams.

3. Industry standard part number or name and model numbers for complete subsystems.

PART 3 EXECUTION

3.1 HMA AND OGSC

A. Construction Requirements
   1. Construct finished pavement to meet the surface requirements in Table 1.
   2. Identify defects exceeding the limits in Table 1 and correct prior to acceptance testing.
      a. Analyze the profile using 0.2 inch blanking band.
      b. Correct defects across the entire width of the traffic lane or shoulder either by grinding with a device approved by the Engineer, or by milling and filling as directed by the Engineer.
      c. Re-profile for correction verification prior to acceptance testing.
   3. Correct transverse defects where the pavement surface varies more than 1/8 inch from the lower edge of a 10 foot straightedge placed perpendicular to the centerline of the roadway.

   4. Seal ground areas with asphalt tack coat and blotter material.
      a. Use a tack coat application rate between 0.07 and 0.14 gal/yd^2.
      b. Meet blotter material requirements in Section 02748, Part 2, Article 2.1.
   5. The Department inspects acceptance testing prior to the placement of Chip Seal Coat, when applicable.

B. Incentive/Disincentive - HMA
   1. Incentive/Disincentive applies only to Class I surfaces for each pavement section defined in Article 1.4, Line B.
      a. Incentive/Disincentive is calculated according to Table 2, with partial sections prorated based on length.
      b. Incentive/Disincentive does not apply to HMA surfaces on projects requiring OGSC.
      c. Any section requiring grinding exceeding 20 yd^2 does not qualify for incentive. Disincentive remains applicable for sections where grinding exceeds 20 yd^2.
   2. Any section still requiring corrective work that is identified at the time of acceptance testing results in loss of incentive for the section. Disincentives remain applicable and are based on PI obtained at the time of acceptance testing.

3. Failure to correct defects, identified at the time of acceptance testing, within 14 calendar days after notification by the Engineer results in liquidated damages assessed at $100.00 per day after 14 calendar days per each section needing corrective work.
    a. Liquidated damages may be waived by the Engineer if it is determined to be in the best interests of the Department to defer corrective work.

C. Incentive/Disincentive - OGSC
1. Incentive/Disincentive applies only to Class I surfaces for each pavement section defined in Article 1.4, Line B.
    a. Incentive/Disincentive is calculated according to Table 3, with partial sections prorated based on length.
2. Any section requiring grinding exceeding 20 yd^2 or any section still requiring corrective work that is identified at the time of acceptance testing results in a disincentive of $1000.00 per section.
3. Failure to correct defects, identified at the time of acceptance testing, within 14 calendar days after notification by the Engineer results in liquidated damages assessed at $100.00 per day per each section needing corrective work.
    a. Liquidated damages may be waived by the Engineer if it is determined to be in the best interests of the Department to defer corrective work.

3.2 PORTLAND CEMENT CONCRETE PAVEMENT (PCCP)

A. Construction Requirements
1. Construct finished pavement to meet surface requirements listed in Table 1.
2. Identify defects exceeding the limits in Table 1 and correct prior to acceptance testing.
    a. Analyze the profile using 0.2 inch blanking band.
3. Correct defects across the entire width of the traffic lane or shoulder by grinding with a device approved by the Engineer.
    a. Re-profile for correction verification prior to acceptance testing.
4. Correct transverse defects where the pavement surface varies more than 1/8 inch from the lower edge of a 10 foot straightedge placed perpendicular to the centerline of the roadway.

B. Incentive/Disincentive - PCCP
1. Incentive/Disincentive applies only to Class I surfaces for each pavement section defined in Article 1.4, Line B.
    a. Incentive/Disincentive is calculated according to Table 4, with partial sections prorated based on length.

2. Any section requiring grinding exceeding 20 yd^2 does not qualify for incentive.
3. Any section still requiring corrective work that is identified at the time of acceptance testing results in loss of incentive for the section. Disincentives remain applicable and are based on PI obtained at the time of acceptance testing.
4. Failure to correct defects, identified at the time of acceptance testing, within 14 calendar days after notification by the Engineer results in liquidated damages assessed at $100.00 per day per each section needing corrective work.
    a. Liquidated damages may be waived by the Engineer if it is determined to be in the best interests of the Department to defer corrective work.

Table 1 Surface Requirements				
Pavement Category	**Class 1 Surface**		**Class II Surface**	
	Section PI	**Profile Deviation**	**Section PI**	**Profile Deviation**
Category	**in/mi**	**in/25ft**	**in/mi**	**in/25ft**
1	**5**	**0.3**	**N/A**	**0.3**
2	**7**	**0.3**	**N/A**	**0.3**
Category 1 **Category 2**	National Highway System and Truck Routes (See Section 02741, Table 11) and all other routes with surfaces having three or more opportunities for improving the ride.* All other routes incorporating single lift overlays with not more than two opportunities for improving the ride.*			
Class I	Surfaces consist of all through traffic and climbing lanes, passing lanes, acceleration and deceleration lanes, shoulders, ramps and turn lanes longer than 1000 ft, including bridges and bridge approach slabs with final riding surfaces placed on the contract. Excluded are horizontal curves having a centerline radius of curvature less than 900 ft and areas within the superelevation transitions to these short radius curves.			
Class II	Surfaces consist of all tapers, road approaches, mainline pavement sections with posted regulatory speeds less than 35 MPH, pavement within 15 ft of bridge decks and approach slabs not paved as part of the project, pavement to a point 50 ft beyond the paving limits of the project and all other surfaces not included in Class 1 and surfaces excluded due to horizontal curves.			

- Each opportunity to improve the ride is one of the following: Placing a gravel or treated base course, OGSC, rotomilling, cold recycling, and each lift of paving. Leveling is not considered as an opportunity to improve the ride.

Table 2 HMA	
Category	**Incentive/Disincentive per Section**
1	**$60 x [(Required in/mi) - (PI)]**
2	**$30 x [(Required in/mi) - (PI)]**

Table 3 OGSC	
Category	**Incentive/Disincentive per Section**
1	**$150 x [(Required in/mi) - (PI)]**
2	**$100 x [(Required in/mi) - (PI)]**

Table 4 PCCP	
Category	**Incentive/Disincentive per Section**
1	**$200 x [(Required in/mi) - (PI)]**
2	**$125 x [(Required in/mi) - (PI)]**

END OF SECTION

Change One - August 29, 2002
No changes made

Change Two - December 19, 2002
No changes made

Change Three - February 27, 2003
No changes made

Change Four - April 24, 2003
No changes made

Change Five – June 26, 2003
Part 1 - Replaced
Part 3 - Replaced

SECTION 01721

SURVEY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Schedule, coordinate, and provide all construction surveying, staking, calculations essential to complete the project and properly control the entire work.

B. Directed surveying as requested by the Engineer.

1.2 RELATED SECTIONS

A. Section 01282: Payment

B. Section 02896: Boundary Survey

1.3 MEASUREMENT PROCEDURES

A. Directed Survey: If extra survey work is needed, a 2-Person Crew measured by the hour authorized. Department makes no additional payment for travel time to and from the project.

B. Directed Survey: If extra survey work is needed a 3-Person Crew measured by the hour authorized. Department makes no additional payment for travel time to and from the project.

1.4 PAYMENT PROCEDURES

A. If needed and approved, directed survey work paid for in the accepted quantities at the following rates:

2 person survey crew	$130.00 per hour
3 person survey crew	$155.00 per hour
1 person computation and /or CAD	$ 65.00 per hour

B. The number of hours required for computations and/or drafting in total cannot exceed 33 percent of actual survey hours, established on a percent basis prior to directed survey work starts.

1.5 SUBMITTALS

A. The Department requires that a Professional Engineer or Professional Land Surveyor registered in the State of Utah sign and seal all submittals.

B. Resubmittals may be required depending on completeness and correctness of the work.

C. Prior to beginning work, submit a statement indicating all Department-provided horizontal and vertical control have been field checked and the control has been determined to be accurate within the tolerances specified in Article 3.4 "Control Point and Survey Tolerances." Attach field survey information used to verify control. If discrepancies are found, notify the Engineer verbally and in writing.

D. Prior to beginning work, provide a written description of the equipment, manpower, methods, and data storage format proposed for use to complete all survey activities.

E. Record keeping: Keep all field notes, diaries, and books according to standard surveying practice.
   1. Loose leaf books not acceptable.
   2. Make available at any time all survey records including field notebooks and forms used for the work to the Engineer upon verbal or written request.
   3. During construction, keep all documentation at a location approved by the Engineer.

F. After project completion, return to the Engineer all surveying and design data and "as staked/constructed" drawings in Microstation format clearly showing all final dimensions, lines, grades, tie-ins and deviations from contract plans.

G. Provide a red-lined hard copy plan set showing as-constructed features denoting changes from the original design.

1.6 QUALITY ASSURANCE

A. Responsible for survey and control of the work, and for correcting Contractor errors, whether the errors are discovered during the actual survey work or in subsequent phases of the project. Bear any cost overruns resulting from Contractor errors.

B. Perform all work in accordance with the plans and specifications and standard Engineering and Surveying practices under the responsible charge of a Professional Engineer or Professional Land Surveyor duly and properly registered in Utah.

C. The Engineer may spot check the work for accuracy and may reject unacceptable portions of work. Resurvey rejected work and correct work that is not within the specified tolerances at no additional expense to the Department.

PART 2 PRODUCTS

2.1 EQUIPMENT

A. Furnish tools, supplies, and stakes suitable for use in highway survey work.

B. Furnish stakes and hubs of sufficient length to provide a solid set in the ground with sufficient surface area above ground for necessary legible markings.

C. Furnish survey instruments and supporting equipment capable of achieving the specified tolerances. Calibrate survey equipment for accuracy prior to beginning survey work and as required.

PART 3 EXECUTION

3.1 PREPARATION

A. Discuss and coordinate the following with the Engineer before survey work begins:
1. Required submittals
2. Survey and staking methods
3. Stake markings
4. Grade control
5. Referencing
6. Structure control
7. Any other procedures and control necessary for the work
8. Documentation procedures

B. Establish construction survey points, elevations and grades as necessary to control layout and complete the work. Verify all control surveying and staking meets specified tolerances for prior to beginning work.

C. Calculate all grades, elevations, offsets and alignment data necessary for staking and/or setting items of work. Obtain approval from the Engineer for alternate methods of establishing grade control with wire lines, computer or laser controlled grading or other suitable methods.

D. Provide appropriate traffic control for all survey activities.

E. The Department furnishes:
   1. Plans showing locations of control points
   2. Plans showing locations of Bench Marks
   3. Cross sections developed during design, if any
   4. Electronic project data, if any
   5. Digital Terrain Model used for design, if any

CONTRACT PROVISION DISCLAIMER

RELEASE OF UDOT DATA: Contractor may obtain an electronic copy of the Data Points prepared by UDOT. UDOT provides data points in Microstation and/or Inroads format only. Contractor responsible for translation into other formats. This data does not include the commercial software needed to read the points. In order to obtain an electronic copy, Contractor makes a written request to the Engineer. Contractor agrees and understands that the data points are prepared by UDOT for its own purposes and not for the benefit of private individuals or businesses. Contractor waives any and all claims that may result from the use of or reliance upon the data points. Contractor indemnifies UDOT and holds it harmless for any damages, costs, attorneys' fees, or other liabilities that might be incurred as a result of the Department's use and reliance on the data.

3.2 DIRECTED SURVEY

A. Conduct directed surveying if requested by the Engineer.
   1. Includes work needed for changes and extra work. Provide all labor, materials, and equipment including global positioning satellite equipment.
   2. Obtain prior written authorization from the Engineer documenting the affected work and requirements before performing work under these items.

3.3 COMPUTATIONS AND PLOTS

A. Use cross-sections to calculate volume measurements.

   1. Superimpose final cross sections with original cross sections and calculate final quantities using the average end area method.

2. Develop cross-sections from field measurements.
    a. Take cross section measurements both before and after excavation and prior to backfill.
    b. When the centerline curve radius is less than or equal to 500 ft, take cross sections at a maximum centerline spacing of 25 ft.
    c. When the centerline curve radius is greater than 500 ft, take cross sections at a maximum spacing of 50 ft.
    d. Take additional cross sections at breaks in terrain and at changes in typical sections.
    e. For each cross section, measure and record points at breaks in terrain, but at least every 25 ft unless otherwise approved by the Engineer.
    f. Measure and record points to at least the anticipated slopes and reference locations.
    g. Reduce all cross section distances to horizontal distances from centerline.
    h. Take cross sections at right angles to tangents and normal to curves.
    i. Include in cross sections all grades, locations, and existing ground line profiles.

3. May develop cross sections from digital terrain models provided that:
    a. The ground survey locations do not exceed 100 ft in any direction
    b. Major breaks in terrain are also included.
    c. The horizontal and vertical control for the project is used
    d. The DTM is verified accurate to require tolerances by spot checking throughout the length of the project.

B. Engineer may approve alternate methods of calculating quantities.

3.4 STAKE MAINTENANCE AND MARKING

A. Maintain ALL staking necessary for the work until the construction has been completed and accepted by the Engineer.
    1. Legibly mark all survey stakes with station and offset referenced to their respective control line.
    2. Mark slope, reference and guard stakes with station.
    3. Renew illegible stakes at no additional cost to the Department.

B. Provide and maintain reference stakes that identify stationing at least every 150 ft until all work has been completed and accepted by the Engineer.

3.5 CONTROL POINT AND SURVEY TOLERANCES

A. Relocate initial horizontal and vertical control points in conflict with construction to areas that will not be disturbed by construction operations. Furnish the coordinates and elevations for the relocated points before the initial points are disturbed.

B. Protect bench marks from construction activities. Position all bench marks to allow a level rod to stand vertically and squarely on the mark. Reference bench marks to centerline and horizontal measurements.

C. Survey and establish control within the following tolerances:

Description	Horizontal	Vertical
	Decimals of a foot	
Control points	" 0.01	" 0.01
Centerline points	" 0.04	" 0.04
Cross sections and slope stakes	" 0.10	" 0.10
Slope stake references	" 0.10	" 0.10
Culverts and Ditches	" 0.10	" 0.10
Minor drainage structures	" 0.10	" 0.04
Curb and gutter	" 0.02	" 0.02
Guardrail and concrete barrier	" 0.05	-----
Retaining walls	" 0.05	" 0.01
Bridge substructure and overall	" 0.01	" 0.01
Bridge superstructure and overall	" 0.01	" 0.01
Environmental Control Limits	" 1.00	-----
Clearing and grubbing limits	" 1.00	-----
Right of Way Limits	" 0.02	-----
Roadway subgrade finish stakes	" 0.10	" 0.10
Roadway finish grade stakes	" 0.04	" 0.04
Signals and electrical	" 0.08	" 0.04
Striping	" 0.08	-----
Paving reference line	" 0.04	" 0.01

Coordinate the survey tolerances of any items not listed above with the Engineer.

D. Staking limits:
   1. Stake clearing limits on both sides of centerline at each established station. Locate the clearing limit on the ground as shown by the cut and fill limits on the plans.
   2. Stake right of way limits every 50 ft maximum on tangents, every 25 ft maximum on curves and at all right of way breaks. If staking distance effects line of sight, reduce the distance.
   3. Stake environmental control limits both sides of centerline at each established station. Locate the environmental control limits on the ground as shown by the slope rounding contours and environmental and silt fence locations as shown on the Plans. Stake environmental control limits every 50 ft and every 25 ft where environmental or silt fence is required.

E. Furnish reference stakes for all slope stakes and stakes used for setting items for work.
   1. Maintain the reference stakes for the duration of the project until the Engineer approves removal.
   2. Establish and set slope stakes and references on both sides of centerline at cross section locations.
      a. When the centerline curve radius is less than or equal to 500 ft, place slope stakes at a maximum centerline spacing of 25 ft.
      b. When the centerline curve radius is greater than 500 ft, place slope stakes at a maximum spacing of 50 ft.
   3. Establish slope stakes in the field as the actual point of intersection of the design slope with the natural ground line.
   4. Set slope stake references outside the clearing limits.
   5. Include all reference point and slope stake information on the reference stakes.

F. After the slope staking is completed, record on the cross section guard stakes the vertical distance from the reference point (RP) to the construction grade, at a minimum horizontal distance of 10 ft outside the clearing limits or at right of way.

G. Setting grade finishing stakes:
   1. For grade elevations and horizontal alignment:
      a. On centerline.
      b. On each shoulder at roadway cross section locations and between centerline and shoulder with a maximum spacing of 15 ft.
      c. At the top of subgrade and the top of each aggregate course.
   2. Locations:
      a. Where turnouts are constructed, set stakes on centerline, on each normal shoulder, and on the shoulder of the turnout.
      b. In parking areas, set hubs at the center and along the edges of the parking area.
      c. Set stakes in all ditches to be paved.

3. Maximum spacing between stakes along the alignment: 50 ft.
4. Use guard stakes, etc. at each grade finishing stake.
5. Reset grade finishing stakes as many times as necessary to construct the subgrade and each aggregate course.

3.6 CONCRETE PAVING

A. Develop a method of horizontal and vertical control for the placement of concrete pavement.
   1. Utilize laser, wire, or string line, for example, to maintain horizontal and vertical control.
   2. Maximum spacing: 50 ft.
   3. Set control on both sides of roadway.

B. Profile surface at each edge of placement and adjust grades for smoothness as approved by the Engineer.

C. Measure pavement thickness every 25 ft and adjust as needed.

D. Stake concrete joint and station stamp locations.

3.7 DRAINAGE STRUCTURES

A. Stake drainage structures to fit field conditions and in coordination with the Engineer. The location of the structures may differ from the plans.
   1. Survey and record the ground profile along centerline of structure
   2. Determine the slope catch points at inlets and outlets.
   3. Set reference points and record information necessary to determine structure length and end treatments.
   4. Stake ditches or grade to make the structure functional.
   5. Plot the profile along centerline of the structure to show the natural ground, the flow line, the roadway section, and the structure.
   6. Mark guard stakes with the following, when applicable:
      a. Diameter, length and type of culvert (for example 18 inch x 35 ft corrugated metal pipe (cmp))
      b. The vertical and horizontal distance from the hub to the invert at the end of the culvert or any intermediate point as needed or directed
      c. Flow line grade of the pipe
      d. Station
   7. For storm sewers and waterlines provide a reference at a maximum spacing of 50 ft. Reference inverts of pipe at all manholes.

3.8 BRIDGES

A. Set a minimum of 3 horizontal and vertical control reference points to be used for surveying all bridge substructure and superstructure components, including but not limited to; pile locations and cutoffs, line and grade for abutments and bents, beam seats, anchor bolts and screed grades.

B. Set intermediate slope stakes at bridge abutments to establish transitions. Place finish grade stakes on the centerline of abutment bearing and at the top of slope of all bridge berms. Place finish grade stakes on each side at top, mid-point or slope and toe of fill.

3.9 BOX CULVERTS

A. Set horizontal and vertical control and reference points. Establish and reference the centerline, back of parapet, skew, and flow line elevations at inlet, outlet and breaks.

3.10 CURB AND GUTTER

A. Set curb and gutter staking at 25 ft intervals on tangent and 10 ft intervals on curve radii. Set line and grade for curb and gutter within 0.02 ft. of the proposed or established grade line.

3.11 GUARDRAIL

A. Stake guardrail vertical and horizontal control at a maximum spacing of 25 ft on tangent sections and 10 ft on curved sections unless otherwise approved.

3.12 EXISTING SURVEY MONUMENTS

A. Under the direction of a surveyor licensed in the State of Utah, locate and reference all private and public land survey monuments that may be destroyed by project construction activities prior to disturbing those existing monuments.

B. Complete referencing and reestablishing those existing monuments at no cost to the Department and before project completion.

C. In some counties the county surveyor references and reestablishes the monuments.
   1. Notify the county surveyor at least 30 days prior to the destruction of any monument.

2. Coordinate the reestablishment of section corner and quarter corner monuments with the county surveyor.
3. Submit drawings and notes showing references to section corners and quarter corners to the Engineer.

D. If a monument is found during construction but is not shown on the contract plans and must be reset, the Department pays for the additional work under the Directed Survey item.

3.13 RETAINING WALLS

A. Set horizontal and vertical control and reference points. Establish and reference the centerline offsets for the walls, radius points, and the beginning and ending wall locations as shown on the plans.

B. Set grade stakes as required for each lift of select material used on the MSE walls.

C. Stake retaining wall vertical and horizontal control at a maximum spacing of 25 ft on tangent sections and 10 ft on curved sections unless otherwise approved.

3.14 CLEANUP

A. Remove and dispose of all flagging, lath, stakes and other staking material after the project is complete.

3.15 UTILITIES

A. As part of cooperating with the utility companies listed in Section 00727, stake control lines as needed so their facilities can be relocated to their proper final position. Also, stake crossings or potential points of conflict between facilities to give proper horizontal and vertical control for the relocation. Schedule this survey work with the utility companies to minimize delays and disruption of survey stakes. Replace all disturbed stakes as necessary to facilitate the relocations. The Contractor is responsible for costs incurred to relocate any utility more than once due to inaccurate or incomplete staking.

END OF SECTION

Change One - August 29, 2002
No changes made

Change Two - December 19, 2002
No changes made

Change Three – February 27, 2003
Articles Revised
1.4 C deleted and moved to Measurement and Payment document

Change Four - April 24, 2003
No changes made

Change Five - June 26, 2003
Revised Articles
3.3 A
3.15 added

SECTION 02741

HOT MIX ASPHALT (HMA)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products and procedures for laying, and compacting a surface course of one or more layers of HMA comprised of aggregate, asphalt binder, lime and other additives.

B. Mix materials at a central mixing plant.

1.2 RELATED SECTIONS

A. Section 01452: Profilograph and Pavement Smoothness

B. Section 02742S: Project Specific Surfacing Requirements

C. Section 02745: Asphalt Material

D. Section 02746: Hydrated Lime

E. Section 02748: Prime Coat/Tack Coat

F. Section 02969: Optional Use of Reclaimed Asphalt Pavement (PG Binder Projects Only)

1.3 REFERENCES

A. AASHTO PP 28: Standard Practice for Superpave Volumetric Design for Hot-Mix Asphalt (HMA)

B. AASHTO T 11: Materials Finer Than 75 Fm (No. 200) Sieve in Mineral Aggregates by Washing

C. AASHTO T 19: Unit Weights and Voids in Aggregate

D. AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates

E. AASHTO T 30: Mechanical Analysis of Extracted Aggregate

F. AASHTO T 89: Determining the Liquid Limit of Soils

G. AASHTO T 90: Determining the Plastic Limit and Plasticity Index of Soils

H. AASHTO T 96: Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine

I. AASHTO T 104: Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

J. AASHTO T 112: Clay Lumps and Friable Particles in Aggregate

K. AASHTO T 166: Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated-Surface Dry Specimens

L. AASHTO T 176: Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test

M. AASHTO T 195: Determining Degree of Particle Coating of Bituminous-Aggregate Mixtures

N. AASHTO T 209: Maximum Specific Gravity of Bituminous Paving Mixtures

O. AASHTO T 255: Total Moisture Content of Aggregate by Drying

P. AASHTO T 283: Resistance of Compacted Bituminous Mixture to Moisture Induced Damage (Modified by UDOT Materials Manual of Instruction Part 8 Test Procedure 8-957)

Q. AASHTO T 304: Uncompacted Void Content of Fine Aggregate

R. AASHTO T 308: Determining the Asphalt Binder Content of Hot-Mix Asphalt (HMA) by the Ignition Method

S. AASHTO T 312: Method for Preparing and Determining the Density of Hot-Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor

T. ASTM D 2950: Test Method for Density of Bituminous Concrete in Place by Nuclear Method

U. ASTM D 3549: Thickness or Height of Compacted Bituminous Paving Mixture Specimens

V ASTM D 3665: Standard Practice for Random Sampling of Construction Materials

W. ASTM D 3666: Specification for Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials

X. ASTM D 4561: Practice for Quality Control Systems for Organizations Producing and Applying Bituminous Paving Materials

Y. ASTM D 4791: Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

Z. ASTM 5506: Practice for Organizations Engaged in the Certification of Personnel Testing and Inspecting Bituminous Paving Materials

AA. ASTM D 5821: Determining the Percentage of Fractured Particles in Coarse Aggregate

BB. ASTM E 178: Practice for Dealing with Outlying Observations

CC. ASTM E 1274: Standard Test Method for Measuring Pavement Roughness Using a Profilograph

DD. Asphalt Institute SP-1, SP-2

EE. UDOT Materials Manual of Instruction Part 8-209: Asphalt Binder Management Plan

FF. UDOT Materials Manual of Instruction Part 8-957: Resistance of Compacted Bituminous Mixture to Moisture Induced Damage

GG. UDOT Materials Manual of Instruction Part 8-958: Standard Test Method for Determining Rutting Susceptibility

HH. UDOT Materials Manual of Instruction Part 8-960: Guidelines for Superpave Volumetric Mix Design

II. UDOT Materials Manual of Instruction Part 8-984: Sampling Methods

1.4 ACCEPTANCE

A. A lot equals the number of tons of HMA placed during each production day. The Department will:

1. Divide each lot into four sublots based on the scheduled production day.

2. Take random samples behind the paver before any further compaction, and determine random numbers/locations from a random numbers table. ASTM D 3665, UDOT Materials Manual of Instruction Part 8-984: Sampling Methods.
    a. Take large enough samples for paired-T testing and split with contractor designated lab until testing discrepancies (based on tests outlined in article 3.9 "Dispute Resolution," paragraph B1, in addition to daily acceptance tests for mix properties) between labs are identified and resolved.
3. Inform the Contractor of the time and place for the sample not more than 15 minutes prior to the sampling.
4. Conduct the following tests:
    a. Asphalt Binder Content: One per sublot using ignition oven. AASHTO T 308
    b. Aggregate gradation: One test per sublot on the residue of the ignition oven tests. AASHTO T 30.
    c. VMA: 3 tests per lot. AASHTO T 312
5. Perform three Rice tests for each lot. Use the average for the lot to determine density of cores taken by the Contractor.
6. Determine thickness of cores taken by the Contractor.
7. Add the lot to the previous day's production if the minimum number of samples cannot be obtained for the final day's production and evaluate with the appropriate sample size.
8. Add the lot to the next day's production if the minimum number of samples cannot be obtained, and evaluate with the appropriate sample size.
9. Retest the lot if an individual test from a sublot is deemed an outlier based on ASTM E 178.

B. The Engineer conducts the acceptance testing for asphalt binder content, gradation, VMA, density, and thickness. AASHTO T 30, T 308, PP 28, T 166, ASTM D 3549. For small projects with plan quantities of HMA less than 3000 tons or for work such as utility work, traffic signals, detours, lane leveling, etc., the Engineer may elect to accept material based upon visual inspection.
    1. When acceptance is intended to be based upon visual inspection, the Engineer reserves the option of conducting any acceptance tests necessary to determine the material and workmanship meets the project requirements.

C. Obtain samples for density and thickness.
    1. Divide the lot into five sublots of approximately equal sizes.
    2. Obtain ten cores per lot randomly as instructed, and in the presence of the Engineer within two days after the pavement is placed.
    3. Comply with AASHTO T 166.

4. If the random location for cores falls within one foot of the edge of the overall pavement section (outer part of shoulders), then move transversely to a point one foot from the edge of the pavement.
5. Fill core holes with an acceptable asphalt mixture and compact.
6. The Department will take possession of the cores immediately, and will begin testing the cores within 24 hours for density acceptance.
    a. Use Table 4 with n=10 to determine PWL for density.

D. Density: The target density for determining acceptance and incentive/disincentive is 93.5 percent of maximum Rice density for projects where design overlay thickness is greater than 2 inches. For projects where design overlay thickness is 2 inches or less, target density for determining acceptance and incentive/ disincentive is 92.5 percent of maximum Rice density. AASHTO T 209. For small projects with plan quantities of HMA less than 3000 tons or for work such as utility work, traffic signals, detours, or lane leveling and when material is to be accepted on the basis of visual inspection per article 1.4 "Acceptance," paragraph B, acceptance for density may be based upon establishing and maintaining a roller pattern to obtain maximum density without over-stressing the pavement.
1. Obtain a minimum of two density determinations on a random basis for each sublot. ASTM D 3665.
2. When samples for gradation, asphalt binder content and VMA from lots are combined according to Part 3, article 3.9 "Dispute Resolution," in order to obtain an appropriate sample size for evaluation, a lot for density determination is defined as the combined production days.

E. Thickness: Base acceptance on the average thickness of a lot. A thickness lot equals a density lot. Divide a thickness lot into five sublots equal to density sublots. Thickness acceptance for thin lift projects (2 inches or less) consists of checking thickness regularly with a depth probe during placement and taking corrective action as necessary.
1. Take a minimum of two randomly selected thickness tests within each sublot.
2. The same core samples taken for density may be used for thickness verification.
3. The Department accepts a lot when:
    a. The average thickness of all sublots is not more than 1/2 inch greater nor 1/4 inch less than the total thickness specified.
    b. No individual sublot shows a deficient thickness of more than 3/8 inch.
    c. Place additional materials where lots or sublots are deficient in thickness. The minimum depth of compacted surface for correcting deficient thickness is 3 times the nominal maximum aggregate size.
    d. The Department pays for the quantity of additional material to bring the surface to design grade.

e. The Department does not pay for the quantity of additional material above the design grade due to the minimum paving thickness required.

f. The Engineer may allow excess thickness to remain in place or may order its removal. Remove and replace the entire depth of the course, if it is necessary to remove portions of the course.

g. The Department pays for 50 percent of the mix in excess of the +1/2 inch tolerance when excess thickness is allowed to remain in place.

h. The thickness tolerances established above do not apply to leveling courses. However, check final surfaces in stage construction.

F. Smoothness Tests

1. Determine acceptance and correct in accordance with Section 01452.

G. Cease production when any two out of three consecutive lots have a net disincentive or the air voids averaged for each lot are not between 3 and 5 percent for any 2 out of 3 consecutive lots.

1. Before production continues, submit a corrective action plan to the Engineer indicating the changes in production procedures that will be implemented to correct the deficiencies.

H. The Department pays incentive/disincentive on the assessed quantities of HMA mix according to Table 1 Incentive/Disincentive for Gradation, Asphalt Binder Content and Density or Table 2 Incentive/Disincentive for VMA. Base the incentive/disincentive on Percent Within Limit (PT) computation using Tables 3, 4, and 5. Use lowest single value combined for gradation (each of the sieves) and asphalt binder content for calculating the gradation/asphalt binder content incentive/disincentive in Table 1.

1. Meet PT of 88 or greater for density for eligibility for incentive in gradation/asphalt binder content and VMA. The Department does not pay incentive for gradation/asphalt binder content and VMA if the Contractor does not meet this condition.

2. For small projects with plan quantities of HMA less than 3000 tons, or for work such as utility work, traffic signals, detours, or lane leveling and when material is accepted on the basis of visual inspection per article 1.4 “Acceptance,” paragraph B, incentives/disincentives do not apply.

I. The Department rejects the lot if the Percent Within Limits (PT) for any individual measurement is less than 60 percent.

J. To reduce over-testing of small quantity production days such as ramps or bridgework, the Engineer may, in concurrence with the Contractor, choose to combine production from several days to form a single lot.

Table 1 Incentive/Disincentive for Gradation, Asphalt Binder Content and Density			
Gradation/Asphalt Binder Content		**Density**	
PT Based on Min. Four Samples	**Incentive/Disincentive (Dollars/Ton)**	**PT Based on Min. Ten Samples**	**Incentive/Disincentive (Dollars/Ton)**
> 99	0.83	> 99	0.83
96-99	0.67	96-99	0.67
92-95	0.37	92-95	0.37
88-91	0.06	88-91	0.06
84-87	-0.24	84-87	-0.24
80-83	-0.54	80-83	-0.54
76-79	-0.84	76-79	-0.84
72-75	-1.15	72-75	-1.15
68-71	-1.45	68-71	-1.45
64-67	-1.75	64-67	-1.75
60-63	-2.06	60-63	-2.06
<60	Reject	<60	Reject

Table 2 Incentive/Disincentive for VMA	
PT Based on Minimum Three Samples	**Incentive/Disincentive (Dollars/Ton)**
> 99	0.49
96-99	0.39
92-95	0.18
88-91	-0.03
84-87	-0.24
80-83	-0.44
76-79	-0.64
72-75	-0.85
68-71	-1.06
64-67	-1.27
60-63	-1.47
<60	Reject

Table 3 Upper and Lower Limit Determination	
Parameter	**UL and LL**
3/4 inch sieve for 1 inch HMA 1/2 inch sieve for 3/4 inch HMA 3/8 inch sieve for 1/2 inch HMA No. 4 sieve for 3/8 inch HMA	Target Value " 6.0%
No. 8 sieve	Target Value " 5.0%
No.50 sieve	Target Value " 3.0%
No. 200 sieve	Target Value " 2.0%
Asphalt Binder Content	Target Value " 0.35%
VMA Production Range Target Range (Field) Target Range (Design)	Field Target Value ± 1.25% 12.5 % - 13.5 % for 1 inch 13.5 % - 14.5 % for ¾ inch 14.5 % - 15.5 % for ½ inch 15.5 % - 16.5 % for 3/8 inch Modified as necessary to meet field target range
Density	Lower Limit: Target Value - 2.0% Upper Limit: Target Value + 3.0%

Table 4 Quality Index Values for Estimating Percent Within Limits										
PU/PL	**n=3**	**n=4**	**n=5**	**n=6**	**n=7**	**n=8**	**n=10**	**n=12**	**n=15**	**n=20**
100	1.16	1.50	1.75	1.91	2.06	2.15	2.29	2.35	2.47	2.56
99	1.16	1.47	1.68	1.79	1.89	1.95	2.04	2.09	2.14	2.19
98	1.15	1.44	1.61	1.70	1.77	1.80	1.86	1.89	1.93	1.97
97	1.15	1.41	1.55	1.62	1.67	1.69	1.74	1.77	1.80	1.82
96	1.15	1.38	1.49	1.55	1.59	1.61	1.64	1.66	1.69	1.70
95	1.14	1.35	1.45	1.49	1.52	1.54	1.56	1.57	1.59	1.61
94	1.13	1.32	1.40	1.44	1.46	1.47	1.49	1.50	1.51	1.53
93	1.12	1.29	1.36	1.38	1.40	1.41	1.43	1.43	1.44	1.46
92	1.11	1.26	1.31	1.33	1.35	1.36	1.37	1.37	1.38	1.39
91	1.10	1.23	1.27	1.29	1.30	1.31	1.32	1.32	1.32	1.33
90	1.09	1.20	1.23	1.24	1.25	1.25	1.26	1.26	1.27	1.27
89	1.08	1.17	1.20	1.21	1.21	1.21	1.21	1.21	1.22	1.22
88	1.07	1.14	1.16	1.17	1.17	1.17	1.17	1.17	1.17	1.17
87	1.06	1.11	1.12.	1.12	1.12	1.13	1.13	1.13	1.13	1.13
86	1.05	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
85	1.03	1.05	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.04
84	1.02	1.02	1.02	1.01	1.01	1.01	1.00	1.00	1.00	1.00
83	1.00	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.96	0.96
82	0.98	0.96	0.95	0.94	0.94	0.93	0.93	0.92	0.92	0.92
81	0.96	0.93	0.92	0.91	0.90	0.90	0.89	0.89	0.89	0.88
80	0.94	0.90	0.88	0.87	0.86	0.86	0.85	0.85	0.85	0.85
79	0.92	0.87	0.85	0.84	0.83	0.83	0.82	0.82	0.82	0.81
78	0.89	0.84	0.82	0.81	0.80	0.79	0.79	0.78	0.78	0.78
77	0.87	0.81	0.79	.0.78	0.77	0.76	0.76	0.75	0.75	0.75
76	0.84	0.78	0.76	0.75	0.74	0.73	0.72	0.72	0.72	0.72
75	0.82	0.75	0.73	0.72	0.71	0.70	0.69	0.69	0.69	0.68
74	0.79	0.72	0.70	0.68	0.67	0.67	0.66	0.66	0.66	0.65
73	0.77	0.69	0.67	0.65	0.64	0.64	0.62	0.62	0.62	0.62
72	0.74	0.66	0.64	0.62	0.61	0.61	0.60	0.59	0.59	0.59
71	0.71	0.63	0.60	0.59	0.58	0.58	0.57	0.56	0.56	0.56
70	0.68	0.60	0.58	0.56	0.55	0.55	0.54	0.54	0.54	0.53
69	0.65	0.57	0.55	0.54	0.53	0.52	0.51	0.51	0.51	0.50
68	0.62	0.54	0.52	0.51	0.50	0.50	0.48	0.48	0.48	0.48
67	0.59	0.51	0.49	0.48	0.47	0.47	0.46	0.45	0.45	0.45
66	0.56	0.48	0.46	0.45	0.44	0.44	0.43	0.42	0.42	0.42
65	0.53	0.45	0.43	0.42	0.41	0.41	0.40	0.40	0.40	0.39
64	0.49	0.42	0.40	0.39	0.38	0.38	0.37	0.37	0.37	0.37
63	0.46	0.39	0.37	0.36	0.35	0.35	0.35	0.34	0.34	0.34
62	0.43	0.36	0.34	0.33	0.33	0.33	0.32	0.31	0.31	0.31
61	0.39	0.33	0.31	0.30	0.30	0.30	0.29	0.29	0.29	0.28
60	0.36	0.30	0.28	0.27	0.26	0.26	0.25	0.25	0.25	0.25
<60	#0.35	#0.29	#0.27	#0.26	#0.25	#0.25	#0.24	#0.24	#0.24	#0.24

Enter table in the appropriate sample size column and round down to the nearest value.

Table 5

Definitions, Abbreviations, and Formulas for Acceptance	
Term	**Explanation**
Target Value (TV)	The target values for gradation, asphalt binder content and VMA are given in the Contractor's volumetric mix design. See article 1.4, D., line E, for density target values.
Average (AVE)	The sum of the lot's test results for a measured characteristic divided by the number of test results; the arithmetic mean.
Standard Deviation (s)	The square root of the value formed by summing the squared difference between the individual test results of a measured characteristic and AVE, divided by the number of test results minus one. This statement does not limit the methods of calculations of s; other methods that obtain the same value may be used.
Upper Limit (UL)	The value above the TV of each measured characteristic that defines the upper limit of acceptable production. (Table 3)
Lower Limit (LL)	The value below the TV of each measured characteristic that defines the lower limit of acceptable production (Table 3)
Upper Quality Index (QU)	QU = (UL - AVE)/s
Lower Quality Index (QL)	QL = (AVE - LL)/s
Percentage of Lot Within UL (PU)	Determined by entering Table 4 with QU.
Percentage of Lot Within LL (PL)	Determined by entering Table 4 with QL.
Total Percentage of Lot (PL) Within UL and LL (PT)	PT = (PU + PL) - 100
Incentive/Disincentive	Determined by entering Table 1 and 2 with PT or PL.

All values for AVE, s, QU, and QL will be calculated to two decimal place accuracy, which will be carried through all further calculations. Rounding to lower accuracy is not allowed.

PART 2 PRODUCTS

2.1 ASPHALT BINDER

A. Refer to Special Provision 02742S: Project Specific Surfacing Requirements.

B. Asphalt material: Refer to Section 02745.

C. Sampling procedure: UDOT Materials Manual of Instruction Part 8-209

D. Asphalt Binder Management Plan: UDOT Materials Manual of Instruction Part 8-209

2.2 AGGREGATE

A. Refer to the Minimum Test Requirements.

B. Crusher processed virgin aggregate material consisting of crushed stone, gravel, or slag. Conform to Section 02969 for recycled mixes.

C. Use the following requirements, including Table 6, to determine the suitability of the aggregate.
   1. Coarse aggregates:
      a. Retained on No. 4 sieve.
   2. Fine aggregates:
      a. Clean, hard grained, and angular.
      b. Passing the No. 4 sieve.

Table 6

Aggregate Properties - HMA			
Test Method	**Test No.**	**Category 1**	**Category 2**
One Fractured Face	ASTM D 5821	95% min.	85% min. (1 inch and 3/4 inch), and 90% min. (1/2 inch and 3/8 inch)
Two Fractured Face	ASTM D 5821	90% min.	80% min. (1 inch and 3/4 inch), and 90% min. (1/2 inch and 3/8 inch)
Fine Aggregate Angularity	AASHTO T 304	45 min.	45 min.
Flat and Elongated 1 to 3 ratio	ASTM D 4791 (Based on 3/8 inch sieve and above)	20% max.	20% max.
L.A. Wear	AASHTO T 96	35% max.	40% max.
Sand Equivalent	AASHTO T 176 (Pre-wet method)	60 min.	45 min.
Plasticity Index	AASHTO T 89 and T 90	0	0
Unit Weight	AASHTO T 19	min. 75 lb/cu. ft.	min. 75 lb/cu. ft.
Soundness (sodium sulfate)	AASHTO T 104	16 % max. loss with five cycles	16 % max. loss with five cycles
Clay Lumps and Friable Particles	AASHTO T 112	2% max	2% max.
Natural Fines	N/A	0%	10% max.
Category 1: National Highway System and Truck Routes - Table 11. Category 2: All Other Routes			

D. Meet gradation requirements in Table 7.

Table 7

Aggregate Gradations (Percent Passing by Dry Weight of Aggregate)					
Sieve Size		**1 inch (SHRP 25 mm)**	**3/4 inch (SHRP 19 mm)**	**1/2 inch (SHRP 12.5 mm)**	**3/8 inch (SHRP 9.5 mm)**
Control Sieves	**1-1/2 inch**	100.0	-	-	-
	1 inch	90.0 - 100.0	100.0	-	-
	3/4 inch	<90	90.0 - 100.0	100.0	-
	1/2 inch	-	<90	90.0 - 100.0	100.0
	3/8 inch	-	-	<90	90.0 - 100.0
	No. 4	-	-	-	< 90
	No. 8	19.0 - 45.0	23.0 - 49.0	28.0 - 58.0	32.0 - 67.0
	No. 200	1.0 - 7.0	2.0 - 8.0	2.0 - 10.0	2.0 - 10.0

2.3 HYDRATED LIME

A. Meet the requirements of Section 02746.

2.4 VOLUMETRIC DESIGN

A. Comply with all requirements for Superpave Volumetric Mix Design according to Asphalt Institute, SP-1, and SP-2, AASHTO PP 28 and the following:
   1. Meet the requirements of Table 8 and Table 9.
   2. Use a laboratory qualified by UDOT Central Materials in the use of the Superpave Gyratory Compactor. AASHTO T 312.
   3. Use an FHWA-protocol approved Superpave Gyratory Compactor.
   4. Meet all volumetric mix design requirements for the selected target gradation.

B. Submit the Volumetric Mix Design data for verification at least 10 working days before beginning paving. Do not begin paving until verification is complete.
   1. Include all information regarding selection of design aggregate structure showing the target values of percent passing on all sieves listed in Table 7, and the design asphalt binder content.
   2. Provide information that aggregate proposed for use meet the requirements of Table 6.
   3. Supply QC data for target job mix gradation selection. Use those target values for price adjustments.

4. After the design is complete, run 4 sets of 2 Gyratory specimens at the design asphalt binder content to verify the optimum asphalt and all other design requirements.

C. Moisture Susceptibility

1. Incorporate hydrated lime into all volumetric designs. Use 1 percent, minimum, for Method A and 1½ percent, minimum for Method B (Section 02746 – Hydrated Lime).

D. Designate asphalt binder supplier.

E. Use gyratory mixing and compaction temperatures supplied by the Engineer.

F. The Department Region Materials Lab verifies the Volumetric Mix Design. UDOT Materials Manual of Instruction Part 8-960: Guidelines for Superpave Volumetric Mix Design. For small projects with plan quantities of HMA less than 3000 tons, or for work such as utility work, traffic signals, detours, or lane leveling, the Region Materials Engineer may accept the Volumetric Mix Design from data submitted with the proposed mix design or from a previous mix design. The Region Materials Engineer reserves the right to verify any mix design submitted.

G. Comply with the following requirements for Superpave volumetric mix design:

Table 8

Volumetric Design Gyrations				
20 Years Design ESALS (Million)	**Compaction Parameters**			**Voids Filled with Asphalt (VFA) (%)**
	$N_{initial}$ /% of G_{mm}*	**N_{design} /% of G_{mm}***	**N_{max} /% of G_{mm}***	
0.3	6/# 91.5	50/ ≥ 96.5	75/ # 98	70 - 80 **
0.3 to <3	7/# 90.5	75/ ≥ 96.5	115/ # 98	65 - 78
3 to < 30	8/# 89	100/ ≥ 96.5	160/ # 98	65 - 75
$30	9/ # 89	125/ ≥ 96.5	205/ # 98	65 - 75

* G_{mm}: Maximum specific gravity of Mix. (Rice Method)
** 67 percent specified lower limit VFA for 1 inch nominal maximum size mixture.

Table 9

Volumetric Design Requirements	
HMA design mixing and compaction temperatures	Provided by the Engineer
Dust Proportion Range	0.6 - 1.40
Voids in Mineral Aggregate (VMA) at N_{design} AASHTO PP 28.9.2, using G_{sb} at SSD. Equation based on percent of total mix.	Sufficient to Achieve Field Performance (Submit calculations or documentation to substantiate)
Hamburg Wheel Tracker UDOT Materials Manual of Instruction Part 8-990	Maximum 10 mm impression at 20,000 cycles.

H. Prepare and submit 2 sets (5 samples each) of ignition oven calibration samples.
   1. Department uses these samples to determine the correction factors for the Region and Field lab ignition oven.
   2. Submit samples a minimum of three working days prior to paving.

2.5 CONTRACTOR INITIATED CHANGES IN MIX DESIGN

A. Submit all requests in writing at least 12 hours prior to incorporating changes into production.

B. Submit a field volumetric mix design for all target changes.
   1. Field volumetric mix design verification consists of 3 sets of 2 gyratory specimens run at the new target gradation and/or asphalt binder content. The Department's previous acceptance tests are allowed for field verification.
   2. If the field volumetric mix design meets the volumetric requirements, the Engineer, in consultation with the Region Materials Engineer, provides written concurrence of the verified field volumetric mix design.
   3. If the field volumetric mix verification does not meet the volumetric requirements, submit a new laboratory volumetric mix design from a laboratory qualified by UDOT Central Materials. Allow at least 4 working days for verification.
   4. The Department performs up to two volumetric mix design verifications at no cost to the Contractor. The Department charges $3000 for each additional laboratory and/or field verification required, including all laboratory or field volumetric mix design verifications required due to contractor initiated target changes.

C. Submit a new laboratory volumetric mix design if changes occur in the aggregate source, asphalt binder source or grade.

D. Do not make changes to production mix until request is reviewed and verified.

PART 3 EXECUTION

3.1 ADDING HYDRATED LIME

A. Method A, Lime Slurry; or Method B, Lime Slurry Marination: Refer to Section 02746.

3.2 HMA

A. Dry aggregate to an average moisture content of not more than 0.2 percent by weight. AASHTO T 255. Adjust burners to avoid damage or soot contamination of the aggregate.

B. Coat with asphalt binder 100 percent of the particles passing and 98 percent of the particles retained on the No. 4 sieve.
   1. AASHTO T 195.
   2. Discontinue operation and make necessary corrections if material is not properly coated.

C. Maintain temperature of the HMA between established limits.
   1. Do not overheat the material or cause thermal damage to the asphalt binder.
   2. Department rejects and Contractor removes materials heated over the established limits.
   3. Remove all material rejected by the Department for overheating.

3.3 HMA PLANT

A. Provide:
   1. Positive means to determine the moisture content of aggregate.
   2. Positive means to sample all material components.
   3. Sensors to measure the temperature of the HMA at discharge.
   4. The ability to maintain discharge temperature of the mix in accordance with the mix design.

B. Asphalt Binder Storage Tanks:
   1. Provide calibrated tanks so the quantity of material remaining in the tank can be determined at any time.

2. Provide a positive means of sampling the asphalt binder from the tanks.

3.4 SURFACE PREPARATION

A. Locate, reference, and protect all utility covers, monuments, curb and gutter, and other components affected by the paving operations.

B. Remove all moisture, dirt, sand, leaves, and other objectionable material from the prepared surface before placing the mix.

C. Complete spot leveling 48 hours before placing pavement courses.
   1. Place, spread, and compact leveling mix on portions of the existing surface.
   2. Fill and compact any localized potholes more than 1 inch deep.

D. Allow sufficient cure time for prime coat/tack coat prior to placing HMA. Refer to Section 02748.

3.5 SURFACE PLACEMENT

A. When full-width or echelon paving is impractical and more than one pass is required, provide a 3:1 (horizontal to vertical) sloped edge adjacent to the next lane to be paved.

B. Adjust the production of the mixing plant and material delivery until a steady paver speed is maintained.

C. Offset longitudinal joints 6 to 12 inches in succeeding courses.
   1. Place top course joint within one foot of the centerline or lane line.
   2. If the previous pass has cooled below 175EF, tack the longitudinal edge before placing the adjacent pass.

D. Offset transverse construction joints at least 6 ft longitudinally to avoid a vertical joint through more than one course.

E. Do not allow construction vehicles, general traffic, or rollers to pass over the uncompacted end or edge of freshly placed mix until the mat temperature drops to a point where damage or differential compaction will not occur.

F. Taper the end of a course subjected to traffic at approximately 50:1 (horizontal to vertical).
   1. Make a transverse joint by saw or wheel cutting and removing the portion of the pass that contains the tapered end.

2. Tack the contact surfaces before fresh mix is placed against the compacted mix.

G. Use a motor grader, spreader box, or other approved spreading methods for projects under 180 yd^2, irregular areas, or for miscellaneous construction such as detours, sidewalks, and leveling courses.

3.6 COMPACTION

A. Use a small compactor or vibratory roller in addition to normal rolling at structures.

B. Operate in a transverse direction next to the back wall and approach slab.

3.7 LIMITATIONS

A. Do not place HMA on frozen base or subbase.

B. Use a UDOT approved release agent for all equipment and hand tools used to mix, haul, and place the HMA. Select from the Performance Data Products Listing (PDPL) maintained by the UDOT Research Division.

C. Do not place HMA during adverse climatic conditions, such as precipitation, or when roadway surface is icy or wet.

D. Place HMA from April 15, and October 15, and when the air temperature in the shade and the roadway surface temperature are above 50 degrees F.
1. The Department determines if it is feasible to place HMA outside the above limits. Obtain written approval from the Engineer prior to paving from October 15, to April 15.

3.8 CONTRACTOR QUALITY CONTROL

This Section does not apply to projects of 20,000 tons or less.

A. General
1. Reference the following standards for qualification, control, and guidelines:
   a. ASTM D 3666
   b. ASTM D 4561
   c. ASTM D 5506
2. Include the following tests in ASTM D 5506, Part 2, "Referenced Documents," for the following:
   a. AASHTO T 308
   b. AASHTO T 312, PP 28

c. AASHTO T 283 Modified by UDOT Materials Manual of Instruction Part 8-957
d. ASTM E 1274

3. Establish and maintain a quality control system providing assurance that materials and completed construction conform to Contract requirements.
4. Identify the Quality Control Manager by name. The Quality Control Manager implements and maintains the Quality Control Plan.
5. Provide the Engineer a certification stating that all the testing equipment to be used is properly calibrated and meets the specifications applicable for the specified test procedures. Provide evidence that Technicians are WAQTC certified. The Engineer may require the Contractor's technician to perform testing of samples to demonstrate an acceptable level of performance.
6. Perform split-sample, paired-T testing with the Department based on project quality control testing using an AASHTO accredited lab.
   a. Perform split-sample, paired-T analysis on all mix acceptance tests related to volumetric properties and the following background testing:
      i. Maximum Specific Gravity of Mix
      ii. Bulk Specific Gravity of Mix
      iii. Bulk Specific Gravity of Coarse Aggregates
   b. Continue until attaining successful Paired-T test results, meeting $\alpha = 0.05$, for a minimum of two consecutive production days.

B. Quality Control Plan (QCP)
1. Provide and maintain a Quality Control Plan covering all personnel, equipment, supplies, and facilities necessary to obtain samples, perform and document tests, and otherwise provide a quality product.
2. Submit the written QCP to the Engineer at least 10 days before beginning operations, or at the Preconstruction Conference.
3. The Department makes no partial payments for materials that are subject to specific quality control requirements without a QCP.
4. The Contractor or independent organization may operate the QCP. However, the Contractor is responsible for the QCP's administration, including compliance with the QCP and any modifications.
5. Address the following minimum items:
   a. Quality control organization chart and area of responsibility and authority of each individual.
   b. Names and qualifications of personnel as required by this Section, article "Quality Control Organization Personnel Requirements."
   c. Provide a description of outside organizations and their services (such as testing laboratories) if employed.
   d. Tests required to be performed, the frequency of testing, sampling locations, and location of the testing facilities.

e. Documentation of test procedures verifying that tests are conducted in accordance with the testing plan, and that proper corrective actions are taken when required.
f. Procedures for verifying that testing equipment is available, complies with specified standards, and is calibrated against certified standards.
g. Procedures for verifying that tests are conducted in accordance with the appropriate ASTM and AASHTO standards.
h. Procedures for submitting test results to the Engineer daily.

6. QCP elements: address all elements that affect the quality of the HMA including:
   a. Mix Design
   b. Aggregate Grading
   c. Quality of Materials
   d. Stockpile Management
   e. Proportioning
   f. Mixing
   g. Placing and Finishing
   h. Sampling and Testing Procedures
   i. Joints
   j. Compaction
   k. Surface smoothness

C. Quality Control Organization
1. Implement the QCP by:
   a. Establishing a separate Quality Control Organization.
   b. Developing an organization chart to show all quality control personnel and how these personnel integrate with other management, production, and construction functions and personnel.
2. Identify all quality control staff on the organization chart by name and function, and indicate the total staff required to implement all elements of the quality control programs, including inspection and testing functions for different items of work.
3. If an outside organization or laboratory is used to implement all or part of the QCP, the personnel assigned are subject to the qualification requirements of this Section. Indicate on the organization chart which personnel are contractor employees and which are provided by an outside organization.

D. Quality Control Organization Personnel Requirements
1. As outlined in ASTM D 3666, Part 7, with the following modifications. Quality Control Manager:
   a. Institutes any actions necessary to successfully operate the QCP in compliance with specifications.

b. Reports directly to a responsible officer in the Contractor's organization.
c. May supervise the QCP on more than one project provided that the Quality Control Manager can be at the job site within one hour after being notified of a problem.

2. Certification of Personnel. As outlined in ASTM D 5506 with the following changes:
   a. Provide a sufficient number of quality control technicians to adequately implement the QCP. These personnel will be either engineers or engineering technicians certified by WAQTC.
3. Quality Control Technicians:
   a. Report directly to the Quality Control Manager.
   b. Inspect all plant equipment used in proportioning and mixing to verify proper calibration and operating condition.
   c. Perform quality control tests necessary to adjust and control mix proportioning in accordance with the job mix formula.
   d. Inspect all equipment used in placing, finishing, and compaction to verify proper operating condition.
   e. Inspect all construction operations to verify conformance with the specifications.
   f. Perform all quality control testing as required by this Section, article "Quality Control Testing."
   g. Detail the criteria to be used in initiating correction of unsatisfactory production processes and construction practices.

E. Quality Control Testing Laboratory
1. Reference ASTM D 4561 with the following additions:
   a. Provide a fully equipped asphalt laboratory located within 30 minutes travel time of the plant or job site.
   b. Keep laboratory facilities clean and all equipment maintained in proper working condition.
   c. Permit the Engineer unrestricted access to inspect the quality control testing laboratory facility and witness quality control activities. The Department advises in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies or testing personnel and procedures.
   d. Suspend work when test results indicate materials are out of specification tolerances. Resume only when the deficiencies are corrected.
      i. Perform quality audits under this standard.
      ii. Refer to UDOT QA Manual.
2. Sampling:
   a. Use a statistically based procedure of random sampling. ASTM D 3665.

b. The Engineer has the right to witness all sampling. UDOT Materials Manual of Instruction Part 8-984: Sampling Methods.

3. Noncompliance:
   a. When quality control activities do not comply with either the Quality Control Program or the Contract provisions, or failure to properly operate and maintain an effective Quality Control Program, the Engineer may:
      i. Order replacement of ineffective or unqualified personnel.
      ii. Carry out the functions and operation of the approved Quality Control Program.
      iii. Deduct costs incurred by the Department to operate the program or otherwise remedy the noncompliance from the total amount due the Contractor.

F. Quality Control Testing
1. Perform all quality control tests necessary to control the production and construction processes applicable to these specifications and listed in the QCP.
2. Establish a testing program to control as a minimum: asphalt binder content, aggregate gradation, VMA, temperatures, aggregate moisture, field compaction, and surface smoothness.
3. Monitoring: The Department reserves the right to monitor any QC testing.
4. Follow the requirements of Table 10, and conduct any additional testing to control the process.

Table 10

Quality Control Testing for HMA	
Testing Method/ Acceptance Documentation	**Testing Frequency**
AASHTO T 308 **Asphalt binder content**: by the ignition method	Minimum 4 tests per lot **
AASHTO T 30 **Gradation**: Mechanical analysis of the remains of the Ignition test.	Minimum 4 tests per lot
AASHTO T 255 **Moisture content**: of aggregate used in production by drying	Minimum One test per lot
Temperature for: dryer, bitumen in the storage tank, mixture at the plant, and mixture at the job site.	Record at least four times per lot
ASTM D 2950 **In-place Density Monitoring** Conduct all testing necessary to meet density requirements.	Minimum 10 density determinations per lot
AASHTO T 312, PP 28 **Field Gyratory Specimens** Verify mix design parameters meet Job-mix requirements, and adjust mix as needed to meet parameters. Mold field gyratory specimens at mix design temperatures determined by the Engineer.	Minimum of one determination (two Gyratory specimens each) of VMA and Air Voids for each lot.

** A lot is defined in article 1.4

G. Control Charts

1. Maintain daily linear control charts both for mean and range. Include in charts aggregate gradation, asphalt binder content, stockpile gradation, VMA, Density and in-place air voids.
2. Post control charts daily in a location satisfactory to the Engineer. As a minimum, identify:
   a. Project number
   b. Contract item number
   c. Test number
   d. Each test parameter

e. Test results

3. Use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the projected data during production indicates a problem and no corrective action is taken, the Engineer may suspend production or acceptance of the material.

H. Quality Control Reports

1. Maintain records and submit daily reports of quality control activities.

3.9 DISPUTE RESOLUTION

A. When disputing the validity of the Department's acceptance tests, submit an engineering analysis within one week of receipt of test results.

B. At a minimum, include the following items in the engineering analysis:

1. Data supporting the Contractor's test results. Data must be based on project quality control testing performed by an AASHTO accredited lab that has performed a split-sample process with the Department and includes:
    a. Split-sample testing performed within the applicable contract
    b. Test data disputed along with:
        i. Maximum Specific Gravity of Mix
        ii. Bulk Specific Gravity of Mix
        iii. Bulk Specific Gravity of Coarse Aggregates
    c. Successful Paired-T test information, meeting $\alpha = 0.05$, for a minimum of two consecutive production days
2. Procedures or issues leading to disputed acceptance test results.
3. Determination of volumetric, durability and long-term structural properties from one or more of the following tests:
    a. Hamburg Rut Tester
    b. 5-Cycle Lottman
    c. Asphalt Pavement Analyzer - Rut and Fatigue tests
    d. Resilient Modulus
    e. SHRP PG Asphalt Binder Tests
    f. SHRP Gyratory Compactor
4. Incentive/Disincentive calculations based on Contractor and Department test values.
5. Recommendations for price adjustment based on expected long-term performance.

C. When paving plans indicate that a reject lot will be covered within 48 hours, the Department immediately reviews the analysis to identify possible discrepancies that can be resolved through validation testing based on the following:

1. Department performs repeat testing on remaining material from original Department test.
2. Department personnel perform repeat testing in the presence of Contractor representative within a 24 hour time period.
3. Use results to validate or invalidate original Department result. Validation test results may not be used in lieu of acceptance results.
4. Base validation on results within two standard deviations (project acceptance samples) of original acceptance result. Remove invalidated test results from acceptance lot and reevaluate lot based on reduced sample size.
5. The Engineer reviews the results and notifies the Contractor of any findings that affect the reject status of the lot along with the Department's position on whether the lot is to be removed or may remain in place at the $15.00/ton deduction for Reject Lot.

D. Within three working days of receipt, the Resident Engineer, Region Materials Engineer, and Region Construction Engineer review the analysis and notify the Contractor in writing of acceptance or rejection. Notification of rejection includes the following:
1. Engineering basis for rejecting the Contractor's analysis, including specific points of objection.
2. Department data and analysis to justify Department position.
3. Time frame for removal of material or pay adjustment to be applied to the lot.

E. When the Department concludes the engineering analysis has merit, the Department, in conjunction with the Contractor, immediately begins a review of the acceptance test results. The review includes, but is not be limited, to the following:
1. Independent Assurance review of all equipment and procedures and methods used for sampling, splitting, and testing.
2. A review of the Department and Contractor's raw test data and calculations for documentation or calculation errors.
3. Production and testing of additional correlation samples.
4. Cross-witnessing of test procedures by Contractor Quality Control and Department personnel.
5. Distribution any other pertinent information.
6. Discussion of other possible means for variation.

Note: If engineering analysis is initiated due to failure of statistical methods to verify Contractor testing and there is no net difference between incentive/disincentive based on Contractor or Department testing, the Engineer may verify contractor test values based on engineering analysis.

F. Do not continue production without concurrence from the Engineer or until differences in the test results are resolved.

G. If errors in testing or reporting are discovered, the Department corrects the applicable test results and re-applies the acceptance/pay adjustment procedures.
   1. If errors are identified that cannot be corrected and the quality of the lot is in question, the Department may choose to evaluate the lot using the Hamburg Wheel Tracker or the Asphalt Pavement Analyzer.
      a. Use 5 stratified random samples cut from the roadway
      b. The Region Materials Engineer and Resident Engineer decide, in conjunction with the Contractor, the status of the lot and associated pay adjustment, based on the following:
         i. Fatigue Life
         ii. Stripping Potential
         iii. Rutting Potential
         iv. Expected Pavement Performance Period vs. Design Life
   2. Errors that are identified within the Department's testing result in a review of the Contractor's schedule and if appropriate, make adjustments to the CPM.

H. If errors in testing cannot be identified, select an Independent Third Party (Agreed on by the Department and the Contractor) to witness sample splitting and testing by both the Contractor and the Department. The Independent Third Party identifies/produces additional material for split-sample testing.

I. If testing errors are identified by the Third Party, the Department makes appropriate adjustments to the acceptance test results and re-applies the acceptance/pay adjustment procedures.

J. The party responsible for the identified error pays for the services of the Independent Third Party.

K. If no errors are identified, the Department evaluates the lot using the original testing results.

Table 11

National Highway System and Truck Routes Category 1		
Interstate Routes	**Beginning**	**Ending**
1-15	Arizona State Line	Idaho State Line
1-70	Jct I-70 - Cove Fort	Colorado State Line
1-80	Nevada State Line	Wyoming State Line
1-84	Idaho State Line	Jct I-80 - Coalville
1-215	Jct I-80 - Parleys Canyon	Jct I -15 - North Salt Lake
US Routes		
US-6	Nevada State Line	Jct US-50 - Delta
US-6	Jct I-15 - Spanish Fork	Jct I-70 - Green River
US –40	Jct I-80 - Park City	Colorado State Line
US-50	Jct US-6 - Delta	Jct I-15 - Holden
US –89	Arizona State Line	Jct I-70 - Sevier
US –89	Jct I-70 - Salina	Jct SR-28 - Gunnison
US-89	Jct US-6 - Spanish Fork	Jct SR-73 - Lehi
US-89	Jct I-15 - Draper, Exit 295	Jct SR-269 - 5th and 6th South
US-89	Jct I-15 - Farmington	Jct I-80 - Uintah
US-89	Jct I-84 - Uintah	Jct SR-134 - North Ogden
US-89	Jct US-91 - Logan	Idaho State Line
US-91	Jct I-15 - Brigham City	Jct US-89 - Logan
US-189	Jct I-15 - South Provo	Jct US-40 - Heber City
US-191	Arizona State Line	Jct I-70 - Thompson
US-666	Jct US-191 - Monticello	Colorado State Line

State Routes	Beginning	Ending
SR-9 - Zions Park		
SR-10 - Castle Valley	Jct I-70 - Fremont Jct	Jct US-6 - Price
SR-12 - Bryce Canyon	Jct US-89 - Panguitch	Jct SR-63 - Bryce Canyon
SR-26 – Riverdale Road	Jct I-15 - Exit 342	Jct US-89 - Ogden
SR-28 - Levan Desert	Jct US-89 - Gunnison	Jct I-15 - South Nephi
SR-31 - Huntington	Mile Post 33	Mile Post 49
SR-36 - Tooele Access	Jct entrance - Tooele Army Depot	Jct I-80 - Tooele Interchange
SR-39 - 20th and 21st Odgen	Jct I-15 - Exit 344	Jct SR-203 - Harrison Blvd
SR-52 - 8th North, Orem	Jct 1-15 - Orem	Jct US -189 - Olmstead Jct
SR-57 - Orangeville Bypass	Jct SR-10 - Hunter Power Plant	Entrance - Wilberg Coal Mine
SR-71 - 7th and 9th East Street, Salt Lake City	Jct SR0-209 - 90th South Street	Jct SR-186 - 4th South Street
SR-73 - Lehi Connection	Jct I-15 - South Lehi	Jct US-89 - South Lehi
SR-79 - 12th Street Ogden	Jct I-15 - Exit 347	Jct SR-203 - Harrison Blvd.
SR-96 - Scofield Access	Mile Post 3	Mile Post 4
SR-111 - Bacchus Highway	Jct SR-48 - Bingham Highway	Jct SR-201 - 21st South Expressway
SR-134 - 2700 North	Jct I-15 - North Ogden, Exit 352	Jct US-89 - North Ogden
SR-152 - Van Winkle Expressway	Jct SR-71 - 9th East Street	Jct I-215 - East (Exit 8)
SR-154 - Bangerter Highway	Jct I-15 - Draper	Jct I-80 - Salt Lake Intl Airport
SR-171 - 33rd and 35th South, Salt Lake City	Jct SR-172 - 56th West Street	Jct I-215 - East, Exit 3
SR-172 - 56th West Street Salt Lake City	Jct 6200 South - Kearns	Jct I-80 - International Center
SR-186 Foothill Blvd	Jct SR-71 - 7th East Street, SLC	Jct I-215 - East (Exit 1)
SR-190 - Big Cottonwood	Jct I 215 - East, Exit 7, SLC	Jct SR-210 - Little Cottonwood
SR-201 - 21st South Expressway	Jct I-80 - Lake Point	Jct I-15 - South Salt Lake
SR-203 - Harrison Blvd	Jct US-89 - South Ogden	Jct SR-39 - 12th Street

State Routes	Beginning	Ending
SR-209 - 90th & 94th South	Jct SR-68 - Redwood Road (SLC)	Jct SR-210 - Little Cottonwood
SR-210 - Little Cottonwood	Jct SR-190 - Big Cottonwood	Jct SR-209 - 90th and 96th South
SR-264 - Skyline Mine Road	Mile Post 12	Mile Post 15
SR-265 - University Parkway	Jct I-15 - Exit 272	Jct I-215 East, Exit 5
SR-266 - 45th & 47th South Taylorsville	Jct I-215 - West, Exit 15	Jct I-215 - East, Exit 5
SR-269 - 5th & 6th South Salt Lake City	Jct I-215, Exit 310	Jct SR-71 - 7th East Street

END OF SECTION

Change One - August 29, 2002
Revised Articles
- **3.8 E 2 a**
  - **3.8 E 2 b**

Change Two – December 19, 2002
No changes made

Change Three – February 27, 2003
Revised Articles
- **1.4 C6a added**
- **1.4 H**
- **Table 3**
- **2.4 A**
- **2.4 C**
- **Table 9**
- **2.5 B 1-3**
- **2.5 B 4 added**
- **2.5 D**
- **3.1 Al deleted**
- **3.2 C3 added**
- **3.7 D1**
- **3.9 B4**
- **3.9 B5 added**
- **3.9 E note added**

Change Four – April 24, 2003
Revised Article
- **3.7 B**

Change Five – June 26, 2003
Revised Article
- **1.2 A**

SECTION 02752

PORTLAND CEMENT CONCRETE PAVEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for constructing Portland Cement Concrete Pavement.

1.2 RELATED SECTIONS

A. Section 00555: Prosecution and Progress

B. Section 01452: Profilograph and Pavement Smoothness

C. Section 03055: Portland Cement Concrete

D. Section 03152: Concrete Joint Control

E. Section 03211: Reinforcing Steel and Welded Wire

F. Section 03390: Concrete Curing

1.3 REFERENCES

A. AASHTO M 154: Air Entraining Mixtures for Concrete

B. AASHTO M 157: Ready-Mixed Concrete

C. AASHTO T 11: Materials Finer Than 75 Fm (No. 200) Sieve in Mineral Aggregates by Washing

D. AASHTO T 23: Making and Curing Concrete Test Specimens in the Field

E. AASHTO T 24: Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

F. AASHTO T 26: Quality of Water to be Used in Concrete

G. AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates

H. AASHTO T 97: Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)

I. AASHTO T 119: Slump of Portland Cement Concrete

J. AASHTO T 121: Weight Per Cubic Foot, Yield, and Air Content (Gravimetric) of Concrete

K. AASHTO T 141: Sampling Fresh Concrete

L. AASHTO T 152: Air Content of Freshly Mixed Concrete by the Pressure Method

M. AASHTO C 457: Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete

N. ASTM D 3405: Joint Sealant, Hot-Applied, for Concrete and Asphalt Pavements

1.4 SUBMITTALS

A. Profilograph: Submit to the Engineer the day following testing, a copy of measured profile data and generated graphic reports containing a scaled reproduction of the measured profile with stationing, deviation information, and document points.

B. Concrete:
   1. Use 3A(AE).
   2. Refer to Section 03055.
   3. Furnish the Engineer with mix design, trial batch gradation, and 28-day compressive strength test results from the trial batches before placing concrete.
   4. Use the same materials and admixtures intended for production in the trial batches.
   5. From the batch trial results, determine the cement content, aggregate ratio, and quantities of other mix components necessary to meet a design 28-day compressive strength of 5210 psi and a 7-day flexural strength of 490 psi.
   6. The proportioning and mixing of the trial batches are subject to inspection.
   7. Do not place pavement before obtaining written approval of the mix design.
   8. Meet the approved trial batch proportions. Changes in the mix proportions require new trial batches.

1.5 PROJECT CONDITIONS/LIMITATIONS

A. **Seasonal:** Do not pave from October 15 to April 15. Submit cold weather concrete plan to the Engineer for written approval to pave outside these limits.

B. **Hot Weather and Cold Weather:** Refer to Section 03055, Part 3.

C. **Night Operations:** Provide proper lighting from one-half hour after sunset to one-half hour before sunrise following Section 00555, article, "Limitation of Operations."

1.6 ACCEPTANCE - OVER LEAN OR UNTREATED BASE COURSE

A. Thickness acceptance is determined by core lengths located randomly one core per 12,000 ft^2 area.

B. Core lengths:
   1. Engineer divides the pavement into consecutive areas not to exceed 12,000 ft^2.
   2. Add a final area of less than 6,000 ft^2 to the previous section to make one section.
   3. A final area of greater than 6,000 ft^2 will constitute a separate area.
   4. Hand-placement areas will be considered separately. Take one core per placement area.

C. Engineer takes three measurements on each core and records to the nearest 1/16 in. Use the average to determine the acceptability and pay factors for deficient thickness areas using Table 2 of Section 02752 found in Measurement and Payment in the Bid Book.

D. Engineer takes two additional cores for any deficient core (one on each side) where the thickness varies by 1/8 in. Locate the new core between the deficient core and each of the adjacent cores.

E. Deficient areas of slab thickness are defined by new cores plotted along with the original cores.

F. Engineer graphs the deficient areas with the following assumptions:
   1. The graph represents the thickness of the pavement.
   2. The thickness varies linearly along the pavement's length from core depth to core depth.
   3. The pavement is a constant depth in the transverse direction.

1.7 ACCEPTANCE - OVER EXISTING SURFACES

A. Thickness acceptance of the finished pavement is determined from the graph of the deviations from the profile grade established by the plans or Engineer.

B. Engineer takes elevations at 100 ft intervals, and compares against the profile and graph to determine deficient thickness areas.

C. Price adjustments for pavement areas with deviations below thickness profile will be computed using Table 3 in Section 02752 found in Measurement and Payment in the Bid Book.

D. The Engineer may accept pavement areas with deviations of more than 0.06 ft at 50 percent pay or require removal and replacement. Make all corrections, including removal and replacement, at no additional cost to the Department.

1.8 ACCEPTANCE - COMPRESSIVE STRENGTH (ACCEPTANCE/RETESTING)

A. Acceptance criteria for compressive strength are detailed in Table 1 of Section 02752 found in Measurement and Payment in the Bid Book.

B. Hand-placement areas will be considered separately.

C. The Engineer notifies the Contractor within three calendar days of determining the 28-day compression if any strength test is below specifications. The Contractor may request referee testing in writing within 35 calendar days after placing concrete.

1. An independent third party testing agency will conduct referee testing within 35 calendar days after placement at no additional cost to the Department.
2. All testing laboratories must:
    a. Be certified by the Cement and Concrete Reference Laboratory.
    b. Use ACI accredited level one or level two inspectors.
    c. Be acceptable to both the Department and the Contractor.
3. Obtain six pairs of cores at locations directed by the Engineer. Condition and wet test the cores as specified in AASHTO T 24.
4. Engineer adjusts the core strengths to a standard equivalent cylinder strength by dividing by a factor of 0.85. Each pair of adjusted core strengths will be averaged and considered as a single core test result.
5. Basis of acceptance of the lot will be as follows:
    a. If any of the adjusted referee core test results are less than 4,000 psi, Engineer uses the lowest core test result or the original cylinder test value, whichever is lowest.

b. If all the six adjusted referee core test results exceed 4,000 psi and the average is below 4,700 psi, Engineer uses the original cylinder test for the pay factor.
c. If all the six adjusted core test results exceed 4,000 psi and the average exceeds 4,700 psi, Department accepts lot at full pay.

D. Engineer and Contractor jointly determine alternate methods of acceptance for the lot represented by a specimen apparently damaged during the curing process or otherwise unacceptable.

E. Fill the core holes with concrete after coring making sure that the holes are cleaned and dry at the time they are filled.
1. Coat the sides of the holes with an epoxy resin adhesive from the Performance Data Products Listing (PDPL) maintained by the UDOT Research Division.
2. Consolidate the concrete by rodding or vibrating.
3. Strike off level with the pavement surface, texture, and treat with the specified curing-sealing compound.
4. Protect concrete in core holes from any damage for a minimum of 48 hrs.

1.9 SMOOTHNESS

A. Determine acceptance and correct in accordance with Section 01452.

PART 2 PRODUCTS

2.1 CONCRETE

A. Use 3A(AE) concrete.

B. Refer to Section 03055: Portland Cement Concrete.

2.2 AGGREGATE

A. Refer to Section 03055 for coarse, fine, and combined aggregates.

B. Separate and stockpile in two sizes coarse aggregate sizes 2 inch to No. 4 sieve, and 1-1/2 inch to No. 4 sieve with the separation being made on the 1 inch and 3/4 inch respectively.

C. Use a No. 200 sieve to determine the material size in accordance with AASHTO T 11 and T 27.

2.3 WATER

A. Use water for washing aggregates, mixing concrete, and at the testing platform that, when compared with distilled water, does not change the setting time of Portland Cement more than 25 percent, or reduce the compressive strength of mortar more than 10 percent.

B. Limit the maximum concentration of sulfate as SO_4 to 3000 ppm.

C. Potable water may be used without testing.

D. Conform to AASHTO T 26.

2.4 ADMIXTURES

A. Air-entraining Agents
   1. Select from the Accepted Products Listing maintained by the UDOT Research Division.
   2. When concrete is central-mixed and transported in non-agitating haul units, incorporate synthetic/non-visol resin air entraining admixtures.
   3. When central-mixed with agitating haul units or transit mixed, conform to the material standard found in AASHTO M 154.
      a. Thoroughly mix all entraining agents before use.
      b. Constantly agitate any agent that settles during batching.

2.5 POZZOLAN

A. Refer to Section 03055.

2.6 CONCRETE CURING COMPOUND

A. Refer to Section 03390, Part 2.

2.7 EXPANSION JOINT MATERIALS

A. Refer to Section 03152, Part 2.

2.8 JOINT SEALERS

A. Unless specified otherwise, provide pre-approved hot applied joint sealant for transverse-sawed, longitudinal-sawed, and all contact joints following Section 03152.

B. Select sealers and joint material from the Accepted Products Listing maintained by UDOT Research Division.

2.9 STEEL REINFORCEMENT

A. Tie Bar: Grade 60, deformed reinforcing steel epoxy-coated following Section 03211.

B. Dowel Bars: Grade 60, smooth steel rod, epoxy- coated, following Section 03211.

2.10 CONCRETE COLORANT FOR STATION MARKERS

A. Brick Red 160 or Tile Red A-28 surface, dry-shake type concrete colorant.

2.11 BATCH PLANT

A. Meet the requirements of the UDOT Quality Management Plan for Ready-Mix Concrete.

B. Equip batch plant with a numerical printout device that makes a continuous, permanent, and accurate record of:
   1. The weights of all individual ingredients including water and cement added after initial batching.
   2. The time of day for each batch shown in hours and minutes.
   3. Date and daily accumulated totals.
   4. Commercial batch plants that are not dedicated to the project are exempt from the daily accumulated total requirement.

C. Give the Engineer a copy of the record at the end of each production day.

D. If the printout device malfunctions, finish the shift following the initial malfunction. Then stop operations until the device is fully operational.

E. Have the beams scales, and water meters on the batching plant checked, certified, and sealed by the Utah Department of Agriculture, Division of Weights and Measures annually and each time the plant or weighing device is moved.

2.12 TESTING PLATFORM

A. Provide a stable, 40 ft by 8 ft testing platform with a canopy when concrete is hauled in dump trucks.
   1. Provide a lockable 8 ft by 10 ft by 8 ft storage room at one end.
   2. Locate the platform within 250 ft of the batch plant.
   3. Platform height must equal the concrete haul truck bed height.
   4. Platform must meet the Department of Labor standards outlined in "Safety and Health Regulations for Construction."
   5. Provide adequate railing, and stairs with a handrail.
   6. Provide 110 V electrical power and pressurized water.
   7. Maintain suitable lights and outlets and a communication system with the batch plant control room.

2.13 VEHICLES FOR HAULING

A. Haul vehicles are limited to the legal axle load.

B. Present certified scale axle weights for each unit in terms of yardage to be hauled.

C. Permissible to use:
   1. End dump trucks with essentially watertight beds and endgates, and rounded corners.
   2. Agitator trucks with open tops.
   3. Transit mixers that conform to the standard found in AASHTO M 157.

D. Do not use bottom or belly dump units.

2.14 CYLINDER STORAGE DEVICE

A. Use a device that maintains a temperature of 60 degrees F to 80 degrees F and is equipped with an automatic 7-day temperature recorder. The recorder's accuracy must be within 2 degrees and have a permanent recording feature.

B. Use device or devices with the capacity to accommodate the required test cylinders and beams for a minimum of two day's operation. Stop placing concrete if capacity is lacking.

C. Make the storage devices available on the job site at least 48 hours before placement.

D. Submit written procedures explaining operation and required monitoring or care of the device for approval.

E. A 24-hour test run may be required.

2.15 SLIP FORM PAVER

A. Self-propelled machine with no fluid leaks, equipped with automatic line and grade control capability.

B. Capable of:
   1. Spreading the dumped concrete uniformly across the grade by an auger or a traveling strike-off device.
   2. Vibrating, tamping, striking-off, and shaping the concrete to the desired line grade and thickness in one continuous pass.

C. Under normal operating conditions, do not place wheeled or tracked power equipment in front of the paver redistributing the concrete.

D. Vibrator minimum requirements:
   1. Eccentric Diameter: 1-7/8 inch
   2. Frequency: 9500 vibrations per minute minimum.
   3. Spacing: 18 inch maximum mounted longitudinally.

E. Operate the vibrators horizontally at the midpoint of the concrete slab and mounted so they maintain this position.

F. Run the vibrators parallel to the direction of the paving.

G. Check each vibrator for operation daily.
   1. Shutdown paving operations immediately if any indication of malfunction occurs.
   2. Resume operations only after repairing or replacing the vibrator.

H. Trailing forms: long enough to leave a smooth, straight, vertical edge.

I. The vibrating and tamping elements: stop when the forward movement of the paver stops.

2.16 FINISHING EQUIPMENT REQUIREMENTS

A. Machine float that may be attached to the paver.

B. Burlap drag.

C. Transverse tining machine (single use) and a comb equipped with steel tines randomly spaced (3/4 in " 1/8 inch).

D. Curing-sealing compound application machine (single use) with a fully atomizing type power spray and a wind protection hood.

E. Dual-use tining and curing machine may be used when placement rate is 100 yds^3/h or less.

2.17 PAVEMENT SURFACE ROUGHNESS TESTING DEVICE - PROFILOGRAPH

A. Refer to Section 01452.

PART 3 EXECUTION

3.1 PREPARATION

A. The profilograph must be on the project site before beginning paving operations.

B. Aggregate Stockpiles
   1. Prepare site by clearing, grubbing, smoothing, and compacting.
   2. Construct stockpile platforms to prevent intrusion of subgrade materials into aggregates.
   3. Provide adequate drainage for the stockpile site.
   4. Construct either individual stockpiles containing materials for a single day of paving, or elongated stockpiles (maximum 25 ft in height, 30 ft top width) with material identified.
      a. Build stockpiles a minimum of two working days before use.
      b. Acceptance of stockpiles is in daily increments only and a maximum of 30 calendar days before use.
      c. May construct standby stockpiles to prevent or avoid delays. Cover until needed.
   5. Construct by distributing over entire base in layers not to exceed 5 ft.
      a. Do not dump or spill over sides.
      b. Equip conveyors with rock ladder or tremie.
      c. Maximum drop from rock ladder or tremie is10 ft.
   6. Restrict conical piles to a 10 ft maximum height before distribution.
   7. Supply loader and operator to assist in sampling for testing.

3.2 APPLICATION - FORMED PAVING OPTION

A. Construct pavement between metal side forms conforming to the guidelines in this Section.

B. Do not allow springing to occur under the weight of paving and finishing equipment.

C. Forms:
1. Keep free from warps, bends, kinks, and keep equal in depth to the specified pavement edge.
2. Maintain deviation of the forms within 1/8 in from a plane in the top surface or within 1/4 in from a plane surface on the inside face.
3. Set at a distance equal to a day's maximum run.
4. Firmly stake side forms using steel dowels placed on each side of every joint, and spaced not more than 5 ft apart.
5. Tightly join form sections by an interlocking joint free of vertical and horizontal movement.
6. Stop paving operation if the side forms do not meet line and grade, or if side forms are loose.
7. Keep side forms in place for at least 12 hours after the concrete has been placed. Clean and oil forms after each use.
8. Remove the side forms without damage to the edge of the pavement. Immediately fill any honeycomb areas at once with mortar composed of 1 part Portland Cement, 2 parts sand, and sufficient water to form a thick paste.
9. Protect the edges of the pavement with curing-sealing compound after the form removal.

D. Vibrators:
1. Attach vibrators to the concrete finishing machine in front of the strikeoff auger and mount as transverse moving or longitudinal fixed at 18 inch maximum spacing to clear tie bars.
2. Vibrator minimum requirements:
   a. Eccentric Diameter: 1-7/8 inch.
   b. Frequency: 9500 vibrations per minute.
3. Use hand-operated vibrators on a regular pattern not to exceed 12 inches in each direction for irregular areas where required.

3.3 LINE AND GRADE CONTROL

A. Establish the necessary stakes for grade control over existing surfaces, and provide the elevation control benchmarks.

B. Use previously established stakes for grade control on the underlying course or courses of lean concrete or asphalt base course.

C. Equip machinery with a control system which automatically controls concrete placement to the specified longitudinal grades.

D. Control systems:
   1. Must be automatically actuated from an independent line and grade control reference using a system of mechanical sensors or sensor-directed devices.
   2. Use sensors that maintain the equipment at the proper transverse slope and elevation to obtain the required thickness and surface.
   3. Furnish, place, and maintain supports, wire devices, and materials as required to provide continuous line and grade reference controls for the placing machine, etc.

3.4 BATCHING MATERIALS

A. As specified for weighing and batching materials. Conform to AASHTO M 157.

B. Batch mixer: Conform to the standard, and operate at the drum speed recommended by the manufacturer.
   1. Do not lose bulk cement and fly ash when transporting into the mixer.
   2. Introduce cement before fly ash.
   3. Add admixtures to the mix water separately and at different times.
   4. Conduct mixing efficiency tests at the beginning of placing concrete, and evaluate as specified in AASHTO M 157, Annex A-1.
   5. Maintain a mixing time of 80 seconds at manufacturer recommended mixing speed after all materials are in the drum. If necessary, increase mixing time in 10 second increments until the mixer efficiency evaluation is passed.
   6. Correct poor mixing efficiency at no additional cost to the Department.
   7. Replace mixing blades when they are worn down 1 inch or more below the original height.
   8. Do not allow buildup of cement or mortar on the mixer drums and blades.

C. Centrally mixed materials:
   1. Base mixing time on the results of the mixer efficiency evaluation, and do not mix less than 80 seconds.
   2. Mix materials for a minimum of 30 seconds after the last addition of water or cement is made after initial batching.

D. Transit mixed materials:
   1. Add a minimum of 30 revolutions at mixing speed when water is introduced after initial batching. Follow AASHTO M 157.
   2. Do not add water to retemper the concrete.
   3. Do not add water to the mix after acceptance testing.

3.5 PLACING CONCRETE

A. Keep the base surface moistened 500 ft in front of the paver without allowing areas of standing water to occur.

B. Place material according to Section 01452, Part 3, article, "Testing Portland Cement Concrete Pavement" and Section 02752 of Measurement and Payment, "Price Reductions for Deficient Thickness," in the Bid Book.

C. Place the concrete to the full width of the pavement in a single operation.

D. Vibrate, screed, and mechanically tamp the spread concrete.

E. Discharge and place the mixed concrete with a lay down machine within the time frame listed below after introducing the mixing water to the cement and aggregates. Reject concrete not placed within the following time period.
   1. Non-agitating Haul Equipment: 35 minutes.
   2. Agitating Haul Equipment: 75 minutes.

F. Deposit the concrete so rehandling is not required.

G. Thoroughly vibrate against and along the faces of the forms.

H. Use shovels or other approved tools for any necessary hand spreading. Do not use rakes.

I. Do not add water to the pavement surface behind the final screed on the paver.

J. Spray water directly on the final burlap drag only in the quantity necessary to keep the burlap wet.

K. Do not add water to the surface for finishing. If water is added, paving operations may be shut down or the concrete rejected.

L. Concrete may be placed in an adjoining longitudinal section three days after initial placement.

M. Provide protection for initial surface.

3.6 HANDLING AND PLACING REINFORCING STEEL

A. Properly store all steel received.

B. Keep tie bars clean, free from damage, and free from distortion.

C. Place tie bars in the middle third of the slab, as shown on the plans.
   1. Refer to Standard Drawings PV 4 and PV 5.
   2. Place normal to direction of paving and parallel to the slab surface.
   3. Hold tie bars, as shown in the plans.
   4. Place by using automatic bar inserters, support on chairs, through forms, or drilled and epoxied in. Manual insertion is not permitted.

D. When load transfer dowel bars are required, place bars in the middle third of the slab depth, parallel to the centerline and surface of the slab. Limit deviations from parallel to 1/4 inch in the length of the dowel bar.

3.7 FINISHING

A. Finish the surface smooth and true to grade by machine float immediately after placing concrete. Finish at a rate equal to the progress of the paving operation.

B. If preliminary finishing is delayed more than 30 minutes after initial screeding, shut down the mixing operation until the situation is resolved.

C. Texture the pavement by burlap drag and transverse tining.
   1. Use at least three plies of wet burlap and drag parallel to the centerline without tearing.
   2. Complete the drag finish with one pass.
   3. Form depressions in the plastic concrete surface with the tining comb:
      a. Randomly spaced (3/4 inch " 1/8 inch).
      b. 3/32 inch to 5/32 inch in deep normal to centerline.
      c. Do not tear or remove excess mortar in the tining process.
   4. Do not tine Category 5 highways as defined in Table 3 in Section 01452.

D. Mark station numbers every 500 ft and date of placement 25 ft from start and finish of a day's placement on the outside edge of the concrete pavement:
   1. After texturing and before curing-sealing.
   2. Use a “brand” with changeable numbers a minimum of 3 inches high.
   3. Smooth an area approximately 9 inch by 18 inch with a float, color with concrete colorant, and press the “brand” approximately 1/4 inch into the concrete to form the appropriate station number.

3.8 CURING

A. Refer to Section 03390, Part 3.

3.9 FIELD QUALITY CONTROL

A. Engineer random samples all concrete.

B. Compliance with the mix design is determined by inspecting the batching procedures.
   1. The Department furnishes the molds and machines for testing.
   2. Furnish material, internal vibrators and storage devices following this Section, Part 2, article, “Cylinder Storage Device” for making and curing the test specimens as per AASHTO T 23.
   3. Maintain cylinders at a temperature range of 60 degrees F to 80 degrees F for the initial curing period of not less than 24 hours.
   4. Cure concrete cylinders and flexure beams in the field a minimum of 24 hours before moving.
   5. Maintain storage devices.

C. Engineer samples materials centrally mixed with non-agitating haul units at the batch plant platform in accordance with AASHTO T 141.
   1. One set of strength tests represents 2650 yds^2 of pavement.
   2. Hand-placed areas are considered separately for strength and thickness.
   3. Run each truckload of concrete past the platform for inspection. The Engineer may test any or all truckloads.
   4. Perform correlation testing to determine the loss of entrained air from the platform to the finished in-place pavement.
      a. Perform air test on concrete at the platform, and again from the same load in the finished pavement. Record any change in the air content.
      b. Make necessary adjustments at the platform to achieve adequate air-entrainment in the finished pavement.
      c. Perform two tests, one in the morning and one in the afternoon, for each day of paving operations.

D. Engineer samples and tests materials centrally mixed with agitating haul units or transit mixed at placement location. One set of strength tests represents 725 yds^2 of pavement or one day's placement whichever is smaller (a lot).

E. Engineer tests air and slump in accordance with AASHTO T 152, and T 119 on the first three loads at startup and after any shutdown of more than one hour.
   1. Slow the batching operation to allow completion of each air and slump test before the next batch is made. Communicate test results to the batch plant operator and make necessary corrections.
   2. Engineer takes random samples during the day. Any samples taken that differ from air or slump test requirements require the testing and acceptance of three consecutive loads before full operation resumes.
   3. Engineer verifies samples that are out of specifications by conducting an additional test on the same load. When the second test is within specifications, Engineer conducts a third test as the deciding factor.

F. Yield tests: Engineer takes in conjunction with an air test at least one per day in accordance with AASHTO T 121.

G. Compressive Strength: Engineer conducts a strength test consisting of one set of three cylinders made at the platform or point of placement. Conform to AASHTO T 23.

H. Flexural Strength: Engineer casts two beams for each day concrete is placed.
   1. Conform to AASHTO T 23 and T 97.
   2. Beams used to determine when a pavement can be opened for traffic shall be cured in the field at the site of the represented pavement.

3.10 PROTECTION

A. Protect pavement against all damage and marring.

B. Keep Contractor hauling equipment and traffic off the pavement until at least ten days after concrete placement as per AASHTO T 97, or until 100 percent of the minimum flexural strength has been achieved.
   1. Use barricades to prevent traffic from using the pavement.
   2. Construct crossings to bridge the concrete as approved by the Engineer when necessary at no additional cost to the Department.

C. Protect from rain and hail damage.
   1. Cease operation when rain is threatening.
   2. Remove, replace, or repair any pavement damaged by rain or hail as directed at no additional cost to the Department.

3.11 JOINTS

A. Construct contact joints, sawed joints, or transverse expansion joints as shown on the plans.

B. Keep the faces of all joints at right angles to the top surface of the pavement with all longitudinal joints parallel to the centerline and coinciding with the traffic lane lines.

C. Place fresh concrete against previously cured concrete at planned locations to form contact joints.
   1. When used, retain transverse contact joint forms in place until paving operations resume.
   2. Join concrete on both sides of all longitudinal and transverse contact joints with tie bars as shown in contract plans.
   3. Maintain the tie bars in their proper position during concrete placement.
   4. Saw and seal all contact joints to the dimensions shown on the plans.

D. Longitudinal contact joints:
   1. Construct with tie bars to the dimensions shown on the plans.
   2. Do not allow the finished surface across longitudinal contact joints to deviate from a straight line by more than 1/8 inch in 10 ft when tested with a straight edge.
   3. Shut down operations until specified tolerances are achieved if the edge slump requirements are not satisfied within 200 ft longitudinally of the start of a contact joint.
   4. If the edge slump exceeds the specified 1/8 inch in 10 ft, repair the edge by the following procedures before placing adjacent concrete:
      a. Saw off the slumped edge to the full thickness with a diamond saw.
      b. Drill holes in the sawed edge and epoxy in new tie bars.
      c. Use No. 8 by 24 inch epoxy-coated tie bars. Place midpoint in the slab at 12 inches on center embedded 12 inches into the slab.
   5. Straighten bent tie bars and re-coat with epoxy paint at the bend point before placing concrete in the adjacent lane.

E. Use power driven saws to construct sawed joints. Maintain a minimum of two working power saws and one working standby power saw during concreting operations.
   1. Single cut all transverse and longitudinal joints (1/8 inch wide) to one third the depth of the design pavement thickness (T/3).
   2. Saw initial or “control” transverse contraction joints at 50 ft intervals or less to control cracking.
      a. Begin sawing immediately after the concrete has sufficiently hardened and before uncontrolled cracking occurs.

b. Conduct continuous sawing operations during both day and night regardless of weather conditions.
c. Provide lighting during nighttime sawing.

3. Immediately flush all joints with water after sawing and wash cuttings from road surface.
4. Thoroughly clean joints of all loose debris, cement powder, etc., with a jet of water at 2000 psi minimum pressure.
5. Keep the transverse joints clean and dry before placing moisture resistant backer rod and/or sealant.
   a. Clean the joint with air at a minimum of 100 psi just before placing the backer rod.
   b. Equip air compressors with operating oil and water traps.
6. Unless specified otherwise, install hot-pour joint sealant (ASTM D 3405) the full depth of the saw cut.
7. Fill the longitudinal joints evenly 1/8 inch " below the pavement surface.
8. Do not permit hauling equipment or traffic on the pavement before all sawed joints are sealed.
9. Match joints in adjacent lanes to form a continuous line across the pavement width including the concrete shoulders.

F. Make night and transverse contact joints normal to the centerline without keyways on the vertical face.
   1. Use No. 10 by18 inch epoxy-coated tie bars placed midpoint in the slab at 12 inches on center and embedded 9 inches on each side.
   2. Form joints with tie bars placed through the form or saw joints with tie bars drilled and epoxied, or as approved.

G. Form transverse expansion joints at structure approaches as shown on the plans by using a joint filler strip and joint sealer.
   1. Firmly support the filler strip by metal holder and end supports which remain in place after completing the pavement.
   2. Secure the metal holder and end supports to prevent movement of the filler strip away from the position indicated on the plans when placing and vibrating the concrete.
   3. Extend the joint filler the full width of the concrete being placed less 1/4 inch on each end.
   4. Remove any concrete which flows around the ends of the joint filler.

3.12 DEFECTIVE PAVEMENT PANELS

A. A panel is that area of pavement within the traffic lane bounded by two transverse joints.

B. Engineer determines defective panels within 21 calendar days after placement.

C. Repair or replace defective pavement panels before acceptance for smoothness at no additional cost to the Department.

D. Remove and replace panels within the traffic lane when multiple full depth cracks separate the panel into three or more parts including the adjacent shoulder.

E. Remove and replace portions of panels within the traffic lane and the adjacent shoulder with any full depth transverse crack within 4 ft or less of a transverse sawed joint. Use methods which do not disturb adjacent panels.

F. Drill and epoxy tie bars as well as dowel bars into existing pavement. Coat dowel bars with a release agent on the free end.

G. Groove to a 1 inch depth by 3/8 inch width and seal any random full depth cracks that open 1/64 inch or more at the surface in 21 calendar days after placement. Silicone sealant required.

H. Leave tight random cracks less than 1/64 inch wide undisturbed.

I. Any core taken for determining full-depth crack is at no additional cost to the Department when the core verifies full-depth cracking.

END OF SECTION

Change One - August 29, 2002
No changes made

Change Two - December 19, 2002
No changes made

Change Three - February 27, 2003
No changes made

Change Four - April 24, 2003
Revised Article
1.8 E 1

Change Five - June 26, 2003
Revised Articles
1.2 B
1.9 added
3.13 deleted

SECTION 02786

OPEN-GRADED SURFACE COURSE (OGSC)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for constructing OGSC.

1.2 RELATED SECTIONS

A. Section 00727: Control of Work

B. Section 01452: Profilograph and Pavement Smoothness

C. Section 02741: Hot Mix Asphalt (HMA)

D. Section 02745: Asphalt Material

E. Section 02746: Hydrated Lime

F. Section 02748: Prime Coat/Tack Coat

1.3 REFERENCES

A. AASHTO T 11: Materials Finer Than 75Fm (No. 200) Sieve in Mineral Aggregates by Washing.

B. AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates.

C. AASHTO T 30: Mechanical Analysis of Extracted Aggregate.

D. AASHTO T 89: Determining the Liquid Limit of Soils.

E. AASHTO T 90: Determining the Plastic Limit and Plasticity Index of Soils.

F. AASHTO T 96: Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine.

G. AASHTO T 104: Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.

H. AASHTO T 112: Clay Lumps and Friable Particle in Aggregate.

I. AASHTO T 176: Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test.

J. AASHTO T 278: Surface Frictional Properties Using the British Pendulum Tester.

K. AASHTO T 279: Accelerated Polishing of Aggregates Using the British Wheel.

L. AASHTO T 304: Uncompacted Void Content of Fine Aggregate.

M. AASHTO T 308: Determining the Asphalt Binder Content of Hot-Mix Asphalt (HMA) by the Ignition Method

N. ASTM D 979: Sampling Bituminous Paving Mixtures.

O. ASTM 3042: Standard Test for Insoluble Residue in Carbonate Aggregate.

P. ASTM 3665: Random Sampling of Construction Materials.

Q. ASTM D 4791: Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

R. ASTM D 5821: Determining the Percentage of Fractured Particles in Coarse Aggregate.

S. UDOT Quality Management Plan - 509 Asphalt Binder.

T. UDOT Materials Manual of Instruction Part 8 - 984: Sampling Method.

U. UDOT Minimum Sample and Testing Requirements, Section 1, Tabulation of Acceptance Sampling and Testing.

1.4 ACCEPTANCE

A. A lot equals the number of tons placed during each production day. When daily production rates are anticipated at less than 900 tons per production day, lots may be increased to equal the number of tons placed during up to three production days as agreed upon in advance by both the Contractor and the Engineer.

B. Submit an engineering analysis within one week, if requesting a rejected lot remain in place.
   1. Include in the analysis: Data and engineering principles that indicate why the pavement should remain in place.
   2. The Engineer, Region Materials Engineer, and Region Construction Engineer review the analysis for acceptance, denial, or revision within three working days.
   3. If the request is denied, remove the rejected material from the project within 72 hours and replace it with an acceptable material.
   4. If rotomilling is required, agree on removal time period.
   5. Department deducts $15.00 per ton if a rejected lot is allowed to remain in place.

C. Binder Content and Gradation

   1. Engineer takes four random samples per lot at the plant according to UDOT Materials Manual of Instruction Part 8 - 894. ASTM D 979, ASTM D 3665.
   2. If only 3 samples can be taken on the production day for reasons beyond the Contractor's control; compute incentive/disincentive from the 3 random samples rather than 4.
   3. Add the lot to the next day's production if 4 random samples cannot be taken. Evaluate pay adjustment with the appropriate sample size.
   4. Add the lot to the previous day's production for the last day's production if four random samples cannot be taken. Evaluate with the appropriate sample size.
   5. Obtain the binder content from the ignition oven test. AASHTO T 308.
   6. Compute Incentive/Disincentive for binder content per lot based on Table 1 using the single test result with the largest deviation from the target.

Table 1

Binder Content	**Pay Adjustment in $/ton OGSC**
Within ± 0.30% of target	+1.00
Between ± 0.31% and ± 0.45% of target	0.00
Between ± 0.46% ± 0.60% of target	-2.00
Greater than ± 0.61%	Reject

   7. Engineer conducts aggregate gradations tests per lot on the residue of the ignition oven test. AASHTO T 30.

8. Incentive/Disincentive for gradation is based on Percent Within Limits computation using Table 2, 3, 4, and 5.
9. The Department will reject the lot if the Percent Within Limits is less than 60 percent.

Table 2	
Gradation Upper and Lower Limit Determination	
Parameter	UL and LL
3/8" sieve	Target Value ± 6.0 percent
# 4 sieve	Target Value ± 6.0 percent
# 8 sieve	Target Value ± 5.0 percent
# 200 sieve	Target Value ± 2.0 percent

Table 3 **Incentive/Disincentive for Gradation**	
Gradation	
PT **Based on Min. Four Samples**	**Incentive/Disincentive** **(Dollars/Ton)**
> 99	0.83
96-99	0.67
92-95	0.37
88-91	0.06
84-87	-0.24
80-83	-0.54
76-79	-0.84
72-75	-1.15
68-71	-1.45
64-67	-1.75
60-63	-2.06
<60	Reject

Table 4 Quality Index Values for Estimating Percent Within Limits										
PU/PL	**n=3**	**n=4**	**n=5**	**n=6**	**n=7**	**n=8**	**n=10**	**n=12**	**n=15**	**n=20**
100	1.16	1.50	1.75	1.91	2.06	2.15	2.29	2.35	2.47	2.56
99	1.16	1.47	1.68	1.79	1.89	1.95	2.04	2.09	2.14	2.19
98	1.15	1.44	1.61	1.70	1.77	1.80	1.86	1.89	1.93	1.97
97	1.15	1.41	1.55	1.62	1.67	1.69	1.74	1.77	1.80	1.82
96	1.15	1.38	1.49	1.55	1.59	1.61	1.64	1.66	1.69	1.70
95	1.14	1.35	1.45	1.49	1.52	1.54	1.56	1.57	1.59	1.61
94	1.13	1.32	1.40	1.44	1.46	1.47	1.49	1.50	1.51	1.53
93	1.12	1.29	1.36	1.38	1.40	1.41	1.43	1.43	1.44	1.46
92	1.11	1.26	1.31	1.33	1.35	1.36	1.37	1.37	1.38	1.39
91	1.10	1.23	1.27	1.29	1.30	1.31	1.32	1.32	1.32	1.33
90	1.09	1.20	1.23	1.24	1.25	1.25	1.26	1.26	1.27	1.27
89	1.08	1.17	1.20	1.21	1.21	1.21	1.21	1.21	1.22	1.22
88	1.07	1.14	1.16	1.17	1.17	1.17	1.17	1.17	1.17	1.17
87	1.06	1.11	1.12.	1.12	1.12	1.13	1.13	1.13	1.13	1.13
86	1.05	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
85	1.03	1.05	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.04
84	1.02	1.02	1.02	1.01	1.01	1.01	1.00	1.00	1.00	1.00
83	1.00	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.96	0.96
82	0.98	0.96	0.95	0.94	0.94	0.93	0.93	0.92	0.92	0.92
81	0.96	0.93	0.92	0.91	0.90	0.90	0.89	0.89	0.89	0.88
80	0.94	0.90	0.88	0.87	0.86	0.86	0.85	0.85	0.85	0.85
79	0.92	0.87	0.85	0.84	0.83	0.83	0.82	0.82	0.82	0.81
78	0.89	0.84	0.82	0.81	0.80	0.79	0.79	0.78	0.78	0.78
77	0.87	0.81	0.79	.0.78	0.77	0.76	0.76	0.75	0.75	0.75
76	0.84	0.78	0.76	0.75	0.74	0.73	0.72	0.72	0.72	0.72
75	0.82	0.75	0.73	0.72	0.71	0.70	0.69	0.69	0.69	0.68
74	0.79	0.72	0.70	0.68	0.67	0.67	0.66	0.66	0.66	0.65
73	0.77	0.69	0.67	0.65	0.64	0.64	0.62	0.62	0.62	0.62
72	0.74	0.66	0.64	0.62	0.61	0.61	0.60	0.59	0.59	0.59
71	0.71	0.63	0.60	0.59	0.58	0.58	0.57	0.56	0.56	0.56
70	0.68	0.60	0.58	0.56	0.55	0.55	0.54	0.54	0.54	0.53
69	0.65	0.57	0.55	0.54	0.53	0.52	0.51	0.51	0.51	0.50
68	0.62	0.54	0.52	0.51	0.50	0.50	0.48	0.48	0.48	0.48
67	0.59	0.51	0.49	0.48	0.47	0.47	0.46	0.45	0.45	0.45
66	0.56	0.48	0.46	0.45	0.44	0.44	0.43	0.42	0.42	0.42
65	0.53	0.45	0.43	0.42	0.41	0.41	0.40	0.40	0.40	0.39
64	0.49	0.42	0.40	0.39	0.38	0.38	0.37	0.37	0.37	0.37
63	0.46	0.39	0.37	0.36	0.35	0.35	0.35	0.34	0.34	0.34
62	0.43	0.36	0.34	0.33	0.33	0.33	0.32	0.31	0.31	0.31
61	0.39	0.33	0.31	0.30	0.30	0.30	0.29	0.29	0.29	0.28
60	0.36	0.30	0.28	0.27	0.26	0.26	0.25	0.25	0.25	0.25
<60	#0.35	#0.29	#0.27	#0.26	#0.25	#0.25	#0.24	#0.24	#0.24	#0.24

Enter table in the appropriate sample size column and round down to the nearest value.

Table 5 Definitions, Abbreviations, and Formulas for Acceptance	
Term	**Explanation**
Target Value (TV)	The target values for gradation, asphalt binder content and VMA are given in the Contractor's volumetric mix design. See article 1.4, line E, for density target values.
Average (AVE)	The sum of the lot's test results for a measured characteristic divided by the number of test results; the arithmetic mean.
Standard Deviation (s)	The square root of the value formed by summing the squared difference between the individual test results of a measured characteristic and AVE, divided by the number of test results minus one. This statement does not limit the methods of calculations of s; other methods that obtain the same value may be used.
Upper Limit (UL)	The value above the TV of each measured characteristic that defines the upper limit of acceptable production. (Table 3)
Lower Limit (LL)	The value below the TV of each measured characteristic that defines the lower limit of acceptable production (Table 3)
Upper Quality Index (QU)	QU = (UL - AVE)/s
Lower Quality Index (QL)	QL = (AVE - LL)/s
Percentage of Lot Within UL (PU)	Determined by entering Table 4 with QU.
Percentage of Lot Within LL (PL)	Determined by entering Table 4 with QL.
Total Percentage of Lot (PL) Within UL and LL (PT)	PT = (PU + PL) - 100
Incentive/Disincentive	Determined by entering Table 1 and 2 with PT or PL.

All values for AVE, s, QU, and QL will be calculated to two decimal place accuracy which will be carried through all further calculations. Rounding to lower accuracy is not allowed.

10. Any lot rejected based on either gradation or binder content will not be eligible for any incentive.

C. Thickness

1. Verify the thickness with a depth probe and take corrective action if necessary.
   a. Minimum thickness: Plan depth minus 1/4 inch.

D. Smoothness

1. Determine acceptance and correct in accordance with Section 01452.

PART 2 PRODUCTS

2.1 ASPHALT MATERIAL

A. As specified, and following Section 02745.

B. Sampling procedure: UDOT Quality Management Plan - 509 Asphalt Binder.

2.2 HYDRATED LIME

A. Meet the requirements of Section 02746.

2.3 AGGREGATE MATERIALS

A. Refer to the UDOT Minimum Sample and Testing Requirements, Section 1, Tabulation of Acceptance Sampling and Testing.

B. Crusher processed virgin aggregate material consisting of crushed stone, gravel, or slag.

C. Meet the following requirements, including Table 3, to determine the acceptability of the aggregate.

1. Coarse aggregate:
   a. Retained on # 4 sieve.

2. Fine aggregate:
   a. Clean, hard grained, and angular.
   b. Passing the # 4 sieve.

Table 6		
Aggregate Properties		
Properties	**Test Method**	**Test Requirement**
One Fractured Face	ASTM D 5821	95 percent min.
Two Fractured Face	ASTM D 5821	90 percent min.
Fine Aggregate Angularity	AASHTO T 304	45 min.
Flat and Elongated (1 to 3 ratio)	ASTM D 4791 (Based on 3/8 inch and above)	10 % max.
L.A. Wear	AASHTO T 96	30 % max.
Sand Equivalent	AASHTO T 176	60 min.
Plasticity Index	AASHTO T 89 and T 90	0
Polish Test	AASHTO T 278 & T 279	31 min.
Soundnes\s (sodium sulfate)	AASHTO T 104	12 % max. loss with five cycles
Clay Lumps and Friable Particles	AASHTO T 112	2 % max.
Standard Test Method for Insoluble Residue in Carbonate Aggregates	ASTM D 3042	30 % max.
Natural Fines	None	None

D. Meet the following gradation:

Table 7	
Aggregate Gradation (Percent Passing by Dry Weight of Aggregate - AASHTO T11, T27)	
Sieve Size	**Percent**
½ inch	100
3/8 inch	90 - 100
# 4	35 - 45
# 8	14 - 20
# 200	2 - 4

2.4 JOB-MIX

A. Obtain approval for job mix gradation:
   1. Submit at least 10 working days before paving.
   2. Show definite single values for the percentage of aggregate passing each sieve based on the dry weight of aggregate.
   3. Stay within the single value gradation limits of Table 4.
   4. Add Hydrated Lime:
      a. Method A, Lime Slurry; or Method B, Lime Slurry Marination.
      b. Refer to Section 02746.
      c. Incorporate minimum hydrated lime by dry weight of aggregate into all mixtures. (1 percent for Method A; 1- 1/2 percent for Method B).

B. Binder Content

   1. The Engineer determines the binder content and supplies samples to determine the correction factor.

C. Changes in job mix gradation:
   1. Submit a written request for a change in a job-mix gradation.
   2. Give the Engineer 5 working days to review and approve the changes and to readjust the quantity of asphalt binder to be used.

PART 3 EXECUTION

3.1 MIXING

A. Mix as specified in Section 02741, Part 3, articles: HMA, and HMA Plant. The mineral aggregate coating will be considered satisfactory when all particles are coated.

3.2 SURFACE PLACEMENT

A. Apply the tack coat at a uniform rate of 0.10 gal/yd^2 undiluted emulsion or 0.15 gal/yd^2 2:1 diluted emulsion. Note: 2:1 diluted emulsion represents 2 parts undiluted emulsion and 1 part water.

B. Maintain a steady paver speed

C. Roll sufficiently to seat without fracturing aggregate.

D. Bring all passes up even transversely at the end of each working day.

E. Construct longitudinal joints within 6 inches of lane lines.

F. Remove slick spots as directed by the Engineer.

3.3 LIMITATIONS

A. Place between May 1 and September 15 and only when both the air temperature in the shade and the pavement surface temperature are above 60 degrees F and rising.

B. Obtain written approval from the Engineer before placing OGSC after September 15.

C. Do not place when it is determined by the Engineer that excessive moisture may be present in the pavement structure.

D. Do not place during rain, when the surface is wet, or during other adverse weather conditions.

END OF SECTION

Change One - August 29, 2002
No changes made

Change Two - December 19, 2002
No changes made

Change Three - February 27, 2003
No changes made

Change Four - April 24, 2003
No changes made

Change Five - June 26, 2003
Articles Revised
1.2 B
1.4 D 1

SECTION 02962

IN-PLACE COLD RECYCLED ASPHALTIC BASE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Mill existing asphalt material to required depth and width.

B. Mix with emulsified asphalt, quick lime slurry, and water if required, place to line and grade and compact.

1.2 RELATED SECTIONS

A. Section 02745: Asphalt Material.

1.3 PAYMENT PROCEDURES

A. Include all costs for quick lime slurry in the item In-Place Cold Recycled Asphaltic Base.

1.4 REFERENCES

A. AASHTO T 26: Quality of Water to be Used in Concrete.

B. AASHTO T 166: Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens.

C. AASHTO T 245: Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.

D. ASTM C 110: Standard Test Methods for Physical Testing of Quicklime, Hydrated Lime, and Limestone.

E. ASTM C 977: Standard Specification for Quicklime and Hydrated Lime for Soil Stabilization.

F. ASTM D 2950: Test Method for Density of Bituminous Concrete in Place by Nuclear Method

G. UDOT Materials Manual of Instruction Part 8-970: Modified Marshall Mix Design For In-Place Cold Recycled Asphaltic Base.

1.5 SUBMITTALS

A. Submit mix design for ENGINEER'S approval prior to commencing cold recycling operation.

B. Provide a Manufacturer's Certificate of Compliance for Quick Lime.

1.6 ACCEPTANCE

A. The Department runs five density tests on each test lot.
   1. A test lot is defined as the amount of cold recycled material placed during one full day's production.
   2. Each density test consists of the mean of three in-place nuclear wet density tests. ASTM D 2950.
   3. Establish the target density by obtaining a sample of loose material from the roadway just ahead of the rolling operation.
      a. Heat sample in oven at 140 degrees F for 2 hours maximum.
      b. Compact mix immediately using standard 50 blow Marshall procedure. AASHTO T 245.
      c. The target for roadway compaction is 96 percent of the mean of 3 Marshall briquettes for each test lot. AASHTO T 166.

B. The Engineer verifies the surface with a 10-ft straightedge at selected sites. Correct surface variations in excess of 3/8-inch by removing or adding material.

PART 2 PRODUCTS

2.1 MATERIALS

A. In-Place Cold Recycled Asphaltic Base gradation:

Sieve Size	Percent Passing
1-1/2 inch	100

B. Use asphalt emulsion as shown on the plans. Refer to Section 02745.

C. Use high calcium pebble quick lime (Hot hydrated lime slurry) that has a minimum dry solids content of 35 percent by weight and that is a pumpable suspension of solids in water. Quick lime slurry must conform to ASTM C 977 using test method ASTM C 110.

D. Use 1.5 percent quick lime by weight of cold recycled base.

E. Use potable water for the quick lime slurry. AASHTO T 26.

2.2 EQUIPMENT

A. Use self-propelled equipment with sufficient power, traction and stability to maintain an accurate depth of cut.

B. Use equipment that will process full depth and lane width in one pass, with screening and crushing capability.

C. Use a machine capable of mixing the pulverized material, emulsified binding agent, and quick lime slurry to a homogeneous mixture.

D. Provide lime slurry equipment that accurately proportions quick lime and water, mixes these ingredients to obtain proper slaking, and maintains a uniform, homogenous slurry. Agitate slurry sufficiently to prevent separation while transporting. Add the lime slurry to the pulverized surfacing by a spray bar at the cutting head on the mill. Accurately meter the slurry into the recycled materials.

E. Use a mixing machine capable of placing the mixed material into a windrow or directly into the hopper of a paver.

F. Separate machinery may be used for mixing.

G. Use a positive displacement pump capable of accurately metering the required quantity of additive down to a minimum rate of 4 gallons per minute.

H. Use a mixing machine that has a meter capable of measuring the flow and total delivery of the additive.

I. When a pick-up machine is used to feed the paver, it must be capable of picking up the entire windrow.

J. Use 30-ton minimum pneumatic rollers.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean or clear away all debris and vegetation within 1 ft of pavement edge.

3.2 RECLAIMED MATERIALS

A. Mill pavement to required depth and width.

B. Control dust created by the cutting action.

C. Crush or screen the reclaimed material to pass a 1-1/2 inch sieve.

D. Reclaimed material must be free of organic materials, soil, or other foreign substances.

3.3 PLACEMENT

A. Place the mixed material with a self-propelled asphalt paver.

B. Adjust emulsion content as pavement conditions change. Repair reclaimed materials when surface ruts or ravels before placement of final wearing surface.

C. Use watering device to prevent materials from adhering to the tires for breakdown or intermediate rolling.

D. Add water to milled material as necessary to facilitate uniform mixing.

E. Continue breakdown rolling until no displacement is noted.

F. Use steel wheel rollers in static or vibratory mode as required for final rolling.

G. Wait 72 hours after a rain or confirm that moisture content is less than 1.5 percent before placing flush, tack, or final surfacing on cold recycled material.

3.4 LIMITATIONS

A. Do not disturb underlying crushed aggregate base.

B. Do not heat screed.

C. Do not park roller or leave idle on uncompacted recycled surface.

D. Perform recycling operations when ambient temperature exceeds 50 degrees F in the shade and pavement temperature exceeds 70 degrees F. Stop recycling operations when weather is foggy or rainy.

E. Prohibit traffic on compacted recycled material for 2 hours after compacting is completed. Remove all loose aggregates by power brooming before allowing traffic on the compacted recycled material.

END OF SECTION

Change One - August 29, 2002
No changes made

Change Two - December 19, 2002
No changes made

Change Three - February 27, 2003
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Change Four - April 24, 2003
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Change Five – June 26, 2003
Entire Section Replaced